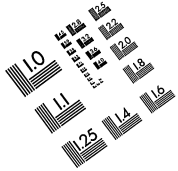
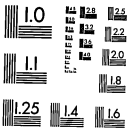
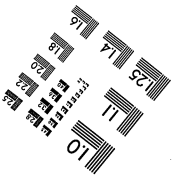
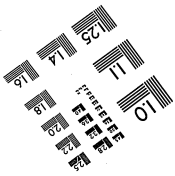


Association for Information and Image Management

MS303-1980







Thomas A Edison Papers

A SELECTIVE MICROFILM EDITION

PART I
(1850–1878)

Thomas E. Jeffrey
Microfilm Editor and Associate Editor

Paul B. Israel
Assistant Editor

Assistant Editors:
Toby Appel
Keith A. Nier
Andre Millard

Susan Schultz
Assistant Editor

Research Associates:
Robert Rosenberg
W. Bernard Carlson

Student Assistants

John Deasey
Leonard De Graaf
David Fowler

Pamela Kwiatkowski
Joseph P. Sullivan
Barbara B. Tomblin

Leonard S. Reich, Associate Director and Associate Editor
Reese V. Jenkins, Director and Editor

Sponsors
Rutgers, The State University of New Jersey
National Park Service, Edison National Historic Site
New Jersey Historical Commission
Smithsonian Institution

University Publications of America
Frederick, Maryland
1985

The original documents in this edition are from the archives at the Edison National Historic Site at West Orange, New Jersey.

FINANCIAL CONTRIBUTORS

PRIVATE FOUNDATIONS

Alfred P. Sloan Foundation
Charles Edison Fund
The Hyde and Watson Foundation
Geraldine R. Dodge Foundation

PUBLIC FOUNDATIONS

National Science Foundation
National Endowment for the Humanities

PRIVATE CORPORATIONS AND INDIVIDUALS

Alabama Power Company
Amerada Hess Corporation
AT&T
Association of Edison Illuminating Companies
Battelle Memorial Institute Foundation
The Boston Edison Foundation
Cabot Corporation Foundation
Carolina Power and Light Company
Consumers Power Company
Corning Glass Works Foundation
Duke Power Company
Edison Electric Institute
Exxon Corporation
General Electric Foundation
Gould Inc. Foundation
Gulf States Utilities Company
The Institute of Electrical & Electronics Engineers
International Brotherhood of Electrical Workers
Iowa Power and Light Company
Mr. and Mrs. Stanley H. Katz
Matsushita Electric Industrial Co., Ltd.
McGraw-Edison Company
Middle South Services, Inc.
Minnesota Power
New Jersey Bell Telephone Company
New York State Electric & Gas Corporation
North American Philips Corporation
Philadelphia Electric Company
Philips International B.V.
Public Service Electric and Gas Company
RCA Corporation
Robert Bosch GmbH
Savannah Electric and Power Company
Schering Plough Foundation
Texas Utilities Company
Thomson-Brandt
Transamerica Delaval Inc.
Westinghouse Educational Foundation
Wisconsin Public Service Corporation

7


START

A Note on the Sources

The pages which were microfilmed for this collection are in generally good condition in the original. There are some pages, however, which due to age are lighter than normal. Additionally, because some volumes are very large and have been bound tightly and cannot be unbound, there are intermittent occurrences of slight distortion of the edges of a small percentage of the pages. We have made every technical effort to ensure complete legibility of each and every page.

UNBOUND NOTES AND DRAWINGS

Unbound notes and drawings are organized by year and within each year by subject. Undated notes and drawings, organized by subject, follow the dated material. The following folders comprise this series:

NS-73-001	Telegraph
NS-74-001	Telegraph - General
NS-74-002	Telegraph - Notes and Essays
NS-75-001	General
NS-75-002	Telegraph
NS-76-001	General
NS-76-002	Telegraph
NS-76-003	Telephone
NS-77-001	General
NS-77-002	Electric Pen and Duplicating Press
NS-77-003	Phonograph
NS-77-004	Telegraph
NS-78-001	General
NS-78-002	Acoustic Devices
NS-78-003	Carbon Rheostat
NS-78-004	Chemophone
NS-78-005	Electric Light
NS-78-006	Ink for the Blind
NS-78-007	Phonograph
NS-78-008	Phonometer
NS-78-009	Tasimeter

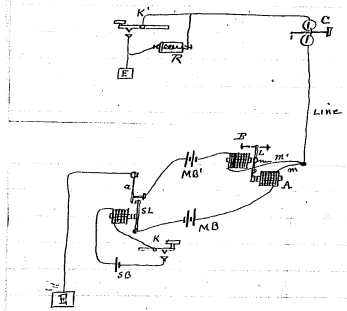
NS-78-010	Telegraph
NS-78-011	Telephone
NS-78-012	Voltameter
NS-Undated-001	General
NS-Undated-002	Chemical
NS-Undated-003	Electric Light
NS-Undated-004	Phonograph
NS-Undated-005	Telegraph
NS-Undated-006	Telephone

1873. Telegraph (NS-73-001)

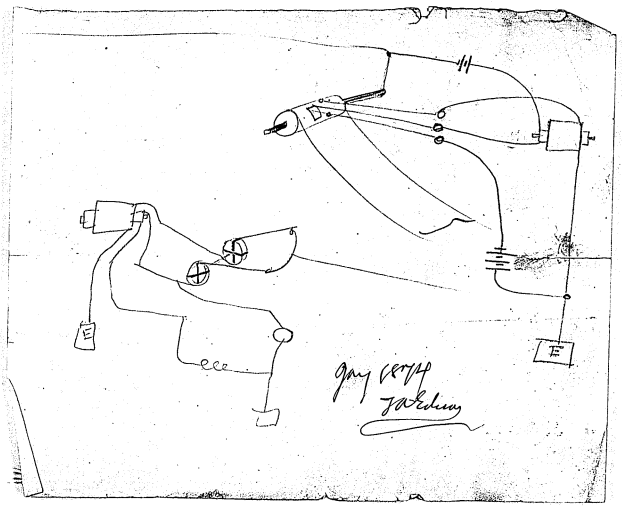
Case "H" .

[1873]

[Duplex telegraph]



1874. Telegraph - General (NS-74-001)


E
E

(10)

10 is the drum by which the Chemically prepared paper is drawn forward a b c d is the four guiding pins, c d are of the length of one letter at end of a b. E comes head from A B to the Contact changing roller Contact roller D C, comes head from above C D to the Contact roller and B A. These Contact rollers are so positioned regarding the two toothed wheels 2.3. which are mounted from each other the which of rest neither set of roller have Contact with the teeth of either wheel but while in motion C D first Comes in Contact with the two teeth of the wheels 2.3. (These wheels are connected one with the

(11)

Line the other with the Earth through the point 4 4-3)
after they leave the teeth B + A
pass on a Co-axle, at no time
is C-D + A-B on a Co-axle
at the same time, It will be
noticed that these recorders
pin a.b. are fixed Connected
with the Line + ground by
D.C. and record half of the
letter, then the pin c.d. are
Connected to the Line +
Earth by the point A-B.
recording the other half-
when this is done a new tooth
on the Escape wheel & will
Come in Contact with the
lever C of the Magnet
+ the wheels 2.3 which are

Caused around by [illegible]
rly will be arrested while
the drum 10 will keep on
at the moment the [illegible]
Diagram wheels are stopped
The Magnet receives a
new impulse from the
large hole in the perforated
paper it releases the wheels
2 + 3. & another letter is
printed,

I shall probably claim:
The arrangement of the
transmitting gear for sending
R + A Currents such as set
forth & for purposes specified
The use of a rec

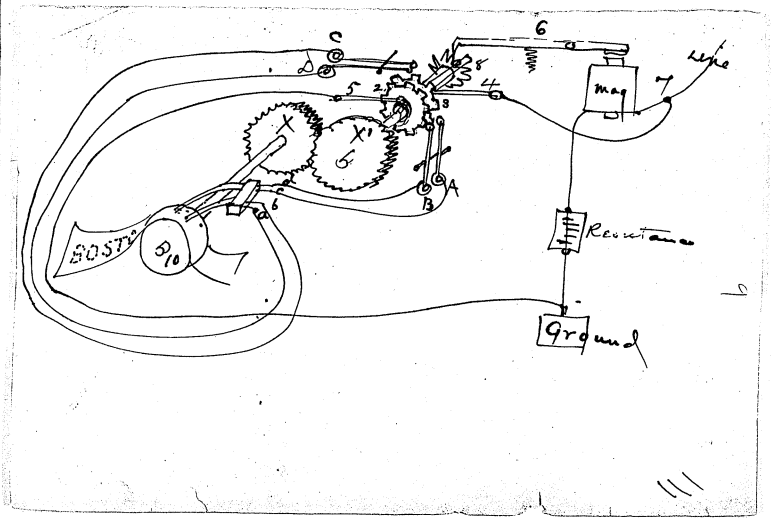
(13)

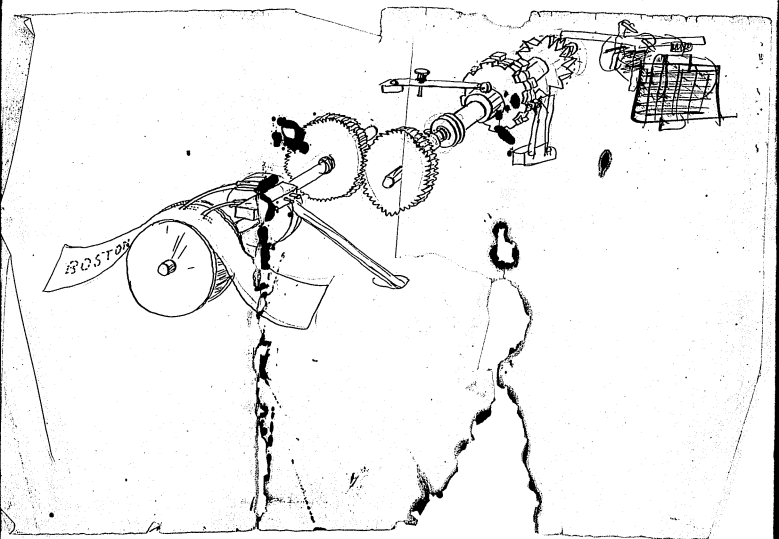
2. The use of an extra perforation in Roman letter perfored stamps for regulating the distant [illegible] Machines either after Each letter word or number of words

3rd. The Circuit changes or its Equivalent from the [illegible]

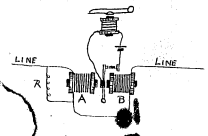
Edison

Feby 1st 1874.


C
6
8
Line
5
2
3
4
mag
7
X
X'
6
A
B
6
Resistance
Ground
10


BOSTON

Feby 3 1874



...ustrated that when line is closed or opened the lever-relay ... spoken of is placed. A is shunted by a ...sistance. The power of the coil on A. are greater than B but the resistance shunts some of the current & makes A only equal to .13. Now on opening the discharge from A circulating within the short circuit formed by R. prolongs the time of its demagnitization enough to put the armature towards it on closing the effect of the ... Induction (self) in A being within a ... ckt prevents for an instant its magnetiza... hence the lever is attracted by B

Notes. 1

[illegible] testing a long magnet for induction [illegible] the current [illegible] its helices otherwise the [illegible] mark will be very irregular [illegible] by the most minute disturbance of the magnetism of the cores creating secondary inductive discharges.

If a nearly exhausted battery, or one which is subject to polarization be placed in perm[illegible] Connection with the primary helice of a [illegible] induction Coil, a continuous discharge [illegible] be detected on the Secondary Coil. by m[illegible] walking across the room. ~~The~~ the lea[illegible] disturbance of the battery will tend to dep[illegible] it & increase for an instant its strength, hence these Secondary discharges.

If a very long magnet with a great number of convolutions be placed in

with a delicate Mirror [illegible]
[illegible] — fig —
A [illegible] by one
a simple Disk of Zinc
in Sal Ammoniac, a
which is powerfully polarized
and the whole apparatus placed on
Masonry. So as to secure perfect quiet
The Sound of the human voice will
be propagated through the air will be
Different to the polarized the Vallum
for an instant and thus increases
strength of the Current passing
the Long Magnet sets up an induced
Current which and the spot of light
will move several degrees on the
Scale if it will.

closes a
in a
Alexander Bell Jr. Patent Office Examiner
to glass signals
. The addition of the
coil consisting of two grams platinum be used
if the R of the sounder is small will
prevent the lever from working. The Current
is so powerful that the platina
points are held together with ~~Consider~~ ills
a force greater than that a
the McCay Illustration Relay 300
Current. 10,000 ohms / cell Da
Signals — dots per minute. On
addition of the local grams Daniels
no signal could be received. to a
~~100~~ — dots per minute The resistance
was reduced to ——
By ~~Using~~ inserting 2 Daniels in pl
of the Grams. the resistance was
reduced only to —— and with
10 cells of ~~most standard~~ high resi

Notes 5

R. Daniel's Relays were used in Conjunction with a Sounder after the R. No appreciable difference was obtained whether the Local Current was Commutated or not.

When a Strong Groove local is passed through a relay lever adjusted for fine ~~a slight~~ the Current produces a magnetic Effect in the armature If there be a slight permanent magnetism in the Cores of the Relay of the the same polarity as that induced into the armature by the passage of the Local Current The lever of the relay will vibrate with great rapidity provoking the Sound is very clear - ~~If the~~ By reversing the direction of the

Local current through the relay lever the vibration will cease.

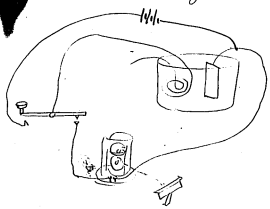
Tapping on a morse key gives two breaks to every dot or dash. In making a dot, the moment the lever touches the contact point it rebounds and closes again, this may be detected by the inductive Charges from an Electromagnet see fig. — Chap. — It is probable that the lever rebounds several times in forming a single dot thereby making several breaks of the Circuit. The inductive Charge of an Electromagnet is very sensitive to these breaks hence the time of magnetization is increased. These principle of this rebound is very much

8 notes,
rebounds, 1 to 2 will take place
when the sounder lever is prevented
from working; the latter producing the
record by jarring the Induction
Coils,

The Groove Ballens may be worked on
the Gravity plan. The platinum like a
Cell and the Zinc being placed at
the top of the jar & the platinum
at the bottom a short distance
from the bottom, the Nitric acid.
The jar being nearly filled with
Water the Nitric acid is
poured through a glass funnel to the bottom, The
internal R is greater than in
the usual form but it gives off
no fumes & is very Constant
The action in this battery is retarded by
the gathering of nitrous oxide at the
Platinum Bottom
Bichromate Pot does not
give as good results,

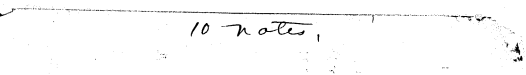
Q. Notes

Leakage Test – for high insulated Gutta Core short lengths –



200 cells 10 minutes, press down Key. The leakage will charge the tub as a secondary battery, so when you let Key go, the Current flows through Mirror, the Copper Core of Cable forms one plate of ~~Battery~~ Secondary battery & the regular Cop plate the other pole of Battery = Try

10 Notes.



6 ohm Sounders may be worked from One two cell Main Cine Grove Battery without enclosure

~~The induction Current of~~

Ten cells of battery ~~Dof~~ 5 of which as opposed to the remaining 5, so that no current is generated, act as secondary batteries to any other battery yeilding a current in the opposite direction to the battery Current

It is probable that no galvanic Current is Continuous but is Composed of an immense number of vibrations. Waves or pulsations, the Continuity of which is dependant

upon the amount of matter ~~of the~~ Cathes themselves and in their neighborhood subject to static Induction, The great the mass of matter the more Continuous the Current just as on ~~the Atlantic~~ a long Submarine Cable of great inductive Capacity Several hundred dots made at one end gives as Continuous Current at the other. ~~One of possible to obtain a powerful battery of small surface~~ a

10 Cells of battery Connected within a close Circuit ~~with~~ with a single cell with it poles opposed to the 10 Cell will remain unaffected until the Current 10 Cells are nearly Exhausted,

12 Notes.

The R. of — Ferrid paper is ——
" " 16 to gal Pod Kal. is ——
2 " " ——
Logwood formula ——
4 varia Sol's no —
ferro — paper Gilly —

With delicate protoxide of iron solution for chemical paper the oxide formed by the action of the oxygen of the air on the pen is sufficient to give a highly contrast mark but the mark is not perceptable at very high speeds.

Dots & Dashes recorded on coil of platinum paper may be transferred to a like paper by a slight pressure & to dry paper by a heavy pressure —

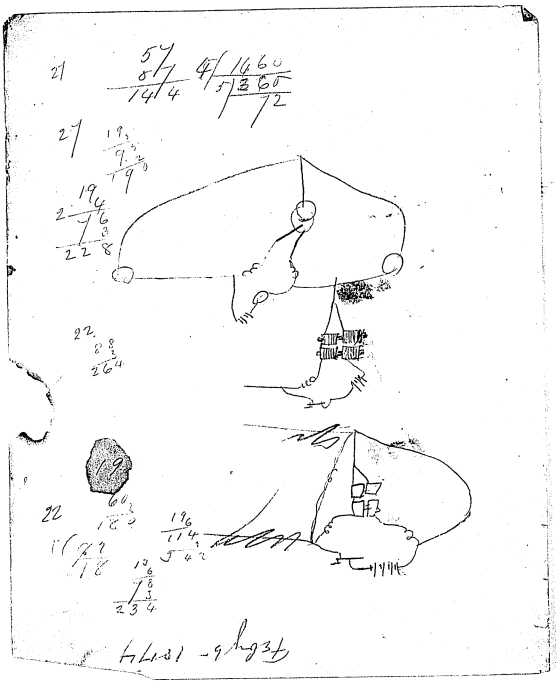
13 Notes

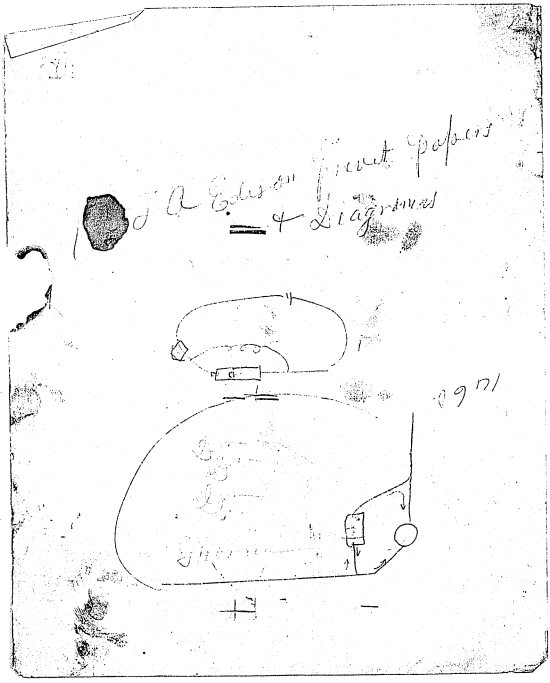
hard drawn platina gives the least spark-
may be drawn nearly as hard as ——— what still

New Carbons for Bunsen battery ~~gives~~
have an average resistance of ——— ohms
which decrease gradually to ——— ohms
in ——— days. ~~Constant use on~~
short circuit =
R of new porous Cups average ——— ohms
which fall to ——— ohms in ——— ———

The Evaporation of a gravity battery is
best prevented by a Wooden Cover
fitting loosely over the Top of
the jar

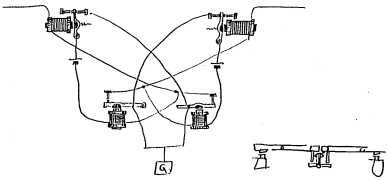
The spark due to short circuiting a large
low R battery in which there is no
Electromagnet may be almost
annulated by the addition of 50
ohms within that portion which form the
short circuit —



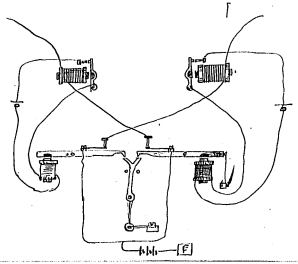

T. A. Edison Circuit Patents
+ Diagrams
+
-

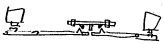
. 1 . Feby 14

John J. Speeds Repeater.
study it out Shaffner. 4 95

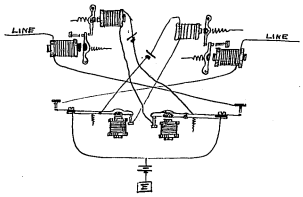


Farmers Repeater Shaffner 736.





Millikens Rep. page 50. 2 Feby 14



Bunnells Repeater -

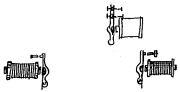
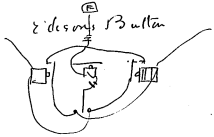


figure Bunnels Rough Letter page 52



Edwin Wilkins Duplex with the 4 July 14 double
retracted Double magnet Relay
any slight difference may be equalized
for by adjusting the magnet A. to or
from the armature, That magnet being
provided with such a device.
The and the equation made without
the Cores of more than one word.
The defects of the relay Consists
1st. approaching of the armat either one or the
Cores of the Electro magnets when the
outgoing Current is so great that magnet
a greater power over it —
2nd. The most serious evil arises from
the fact that the Route for the
Self induction Currents generated in
A. are generated on a Circuit
having Several thousand ohms
Resistance hence their Effect upon
the Changing & discharge time
of the Magnet A. is very small
One the other hand, The discharge
Route for the Self induction Current
generated in the magnet B. Owing
to defective insulation has a much

Shorter Circuit to discharge when
Lever is Electromagnet strength is
greater and its tendency is to
prolong the Magnetic time on clearing
to prevent the magnet B from being
instantly magnetized while the
Current from A. having much
Charges almost instantly, this of
Course tends to draw the lever
for the first instant strongly
towards A. When the Current is
permanent. The induction
Currents have subsided & both
magnets attract the
armature with Equal force
Now on opening A almost
instantly loses its magnetism
while the discharge from B.
still Continues to circulate
through B & the amount formed
by the time & derivation due to
leakage & prolongs the magnetism
of B beyond that of A.
Thus of Course for the first instant
gives the lever a bias towards B,
The greater the Escape the more perceptible
the difficulty will become,

1 Notes Feb 15th 1874.

VII

~~Siemens~~ 1 ohm is equal to the resistance of a column of mercury one square millimetre section & about 106 ~~40~~ metres long at 32 Fahrenheit A Siemens unit is about $\frac{95}{100}$ths of an ohm.

If in a telegraph wire 400 miles in length all conditions the same, if the total amount of static charge be equal to 16 then by dividing the wire up into 4 parts of 100 miles each the ~~first~~ part next the battery will have a charge of 4 parts the next will have 3 parts, the next 2 parts & the next 1 parts.

Hence the centre of accumulation of static charge is 120 miles from battery.

The quantity of inductive electricity accumulated on any telegraph wire if say 400 miles in length

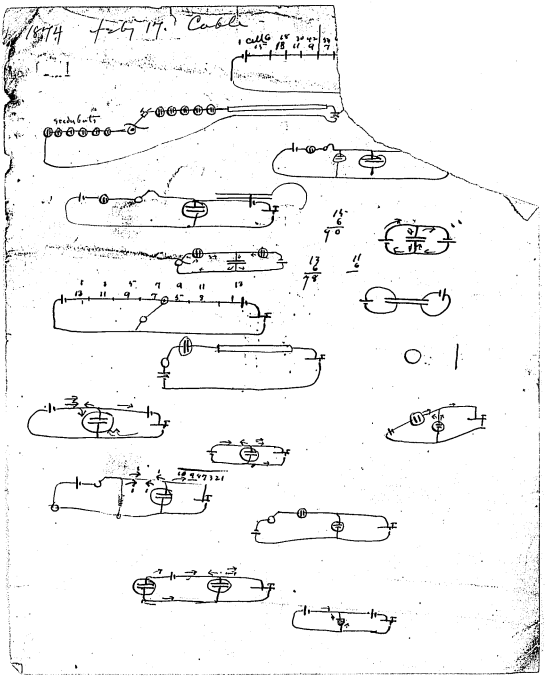
is proportional to the diam. of wire. its distance from ground, number of wires on the pole, distance of wires apart, mass of insulator in pole & insulator. The time that the accumulation will practically cease after the battery has been disconnected is in proportion to the resistance of the pole itself & all its derivations formed by the leakage.

The electromotive [illegible] cell whose C.I. plate is immersed in a concentrated solution of sulphate of copper & whose Zinc is immersed in a solution of sulphuric acid of the proportion of $1 - \frac{1}{20}$ is commonly adopted as the unit of E.M.F.

Sabine 317.

3 Note Feb 1/15

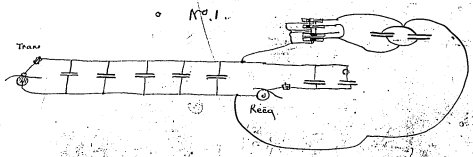
Fechners method of comparing the electromotive forces of 2 elements consists in measuring the intensities of 2 currents when R are equal He employs a galvan. with fine wire & many convolutions round & places this galvan & battery in a circuit of large R say 10'000 ohms in order to be able to neglect the R of the element itself


1874 Feb 17. Cable
1 cable
Spark Coils

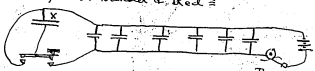
May 16 1874.

Experiments por Société du Cable Transatlantique Français
Por Mr Edison + Batchelor

No. 1.



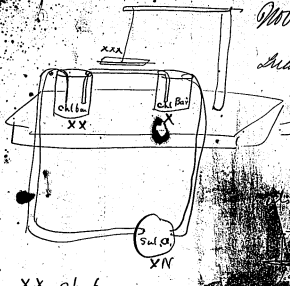
X is of same Capacity as now used on end
viz 1 Bunch of Red



Duke Rec'd

Nov. 2nd 1876

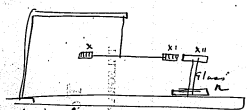
Read this
in proof
C & B



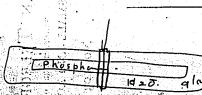
XX. Ch Bar
XX also H_2O & U
XXX Ch Bar
also H_2O in XX & X
& SO_3 in XN. Chemist
ought to draw XXX from right
angle to parallel

4

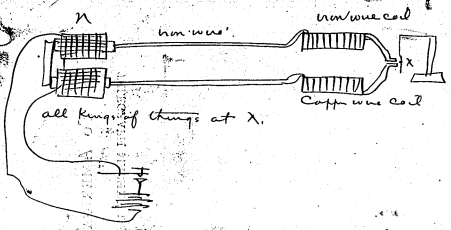
absorbing the way.



X & X1 are pieces of pipe mounted with rubber
and around to pieces of glass rod, also to
metallic rod. N is a stand and
with glass rod. on top is XII a piece of
pipe mounted with another solution,

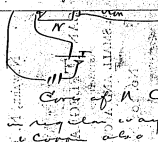


Nov 2nd 1874



N Battery Copper disk quantity Magnet Iron wire quantity in jar

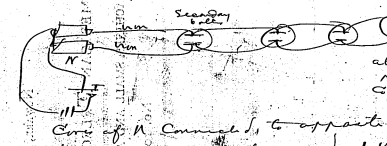
dispense with Copper Coil + iron coil use Long iron wire 50 feet long both ends also Ido. Copper wire also wet string + iron wire, string Mouth & with various chemicals also "copper wire + wet string also close these various Conductors of Electromagnetism to galvanometer when X is attached = when Current is on break Circuit of iron or copper from Coil of magnet



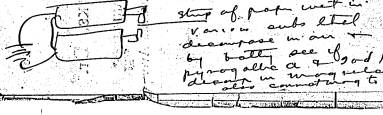
Coil of N Connect to apparatus + in negative way — also used 1 iron + Copper also 2 Copper wires, also wet string, org wire covered, dry cotton with various chemicals,

stop of pots wet in various substances dissolve in air + by bottle see Book K Mercury alloy a good fuse Electric in mercury into fuse see connecting to stopper

also second Receiver Current.
Try at X tube, with various chems
Also Connect the two helix of
Electromagnet not Opposite each
other, spread no magnetism
and by all over again ——



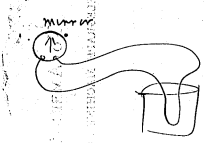
Core of N Connect S to opposite X
in regular way — also used 1 iron
& Copper also 2 copper wires,
also with shunt, wrapped Cardinal;
try each with various chems,



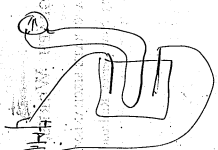
Shunt of post mark in
various subtle
disposes wire on
by battery see Board K
Mercury also a good fuse
Electric in magnetic fuse
etc. connecting to opposite

7 Jan 2' 1.04 pt

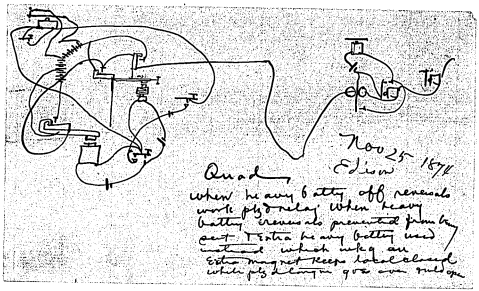
Shellac
glass
Tube with hydrocarbon,
Tube with metal inside with acid
attacking them —
Salts crystallizing —

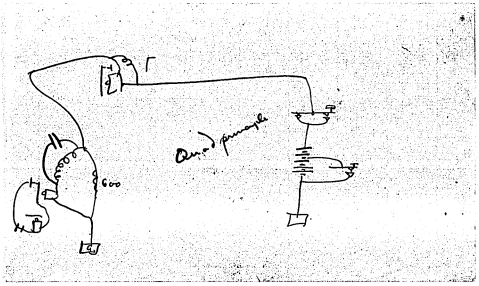


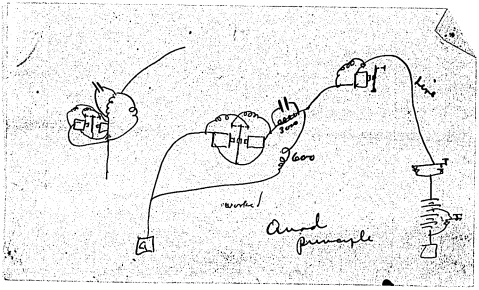
various chemicals with loops of various wire,
precipitate formed a depolarizing also
acid to attack metal inside,
also thin



Exp. to find some new phenomena


Nov 25 1876
Edison
Quad
when he uses 6 cells off reverses
work polarity relay. When heavy
battery reverses galvanometer plays by
easy. When he uses battery used
for


600
Quad principle


600
work
Quad
principle

1874. Telegraph - Notes and Essays (NS-74-002)

This folder contains notes and drafts for a proposed book or series of essays by Edison on telegraphy and related electrical subjects. Similar material can be found in NS-74-001 and NS-Undated-005, Unbound Notes and Drawings; in Laboratory Scrapbook, Cat. 297; in Laboratory Notebook, Cat. 30,099; and in Laboratory Notebook, Cat. 1176. The essays on duplex telegraphy (items 4-6, below) appear to have been prepared for The Operator, Vol. 2, nos. 1, 3, 6 (1876). The essay "On the Effect of Self Induction . . ." (item 19, below) was prepared for The Telegraphic Journal, according to a docket on the back of one of the pages. The following is a list of the documents in this folder:

1) "The author of this work . . ." (1 page; incomplete).

2a) "Notes & Ideas for Book." (3 pages; Edison's hand).

2b) Transcription of (2a). (1 page).

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

3c) Transcription of (3b) plus some additional material. (18 pages).

3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).

4) "We will suppose that . . ." (7 pages; incomplete; Edison's hand).

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

5b) "The Duplex principle . . ." Another version of (5a). (9 pages; incomplete; Edison's hand).

6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

6b) Pages 1-7 of (6a) in Edison's hand. (11 pages).

7a) "Induction Relay." (9 pages; incomplete; Edison's hand).

7b) Transcription of (7a). (4 pages).

8a) "Morse Telegraph contends with Line," page 2. Transcription. (1 page; incomplete).

8b) This appears to be a continuation of (8a) in Edison's hand. (1 page).

8c) Transcription of (8b). (1 page).

9) "Chemical paper . . ." Transcription. (3 pages).

10) "In the American System . . ." Transcription. (2 pages).

11) "Printing Telegraphs." (9 pages; Edison's hand).

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

12b) "Break Wheels." Another version in Edison's hand. (5 pages with Batchelor's annotations).

12c) Pages 16 (2 versions), 17, and 18 of (12a) or (12b). (4 pages; Edison's hand).

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).

13) "Electromagnets." (4 pages; Edison's hand).

14) "The laws which govern . . ." (2 pages; Edison's hand).

15) Incomplete essay, pages 9, 12, 14, and a damaged page. (4 pages; Edison's hand).

16) Incomplete essay, pages 21-23. May be a continuation of (15). (3 pages; Edison's hand).

17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).

18) "If a current be sent . . ." (1 page; Edison's hand).

19) "On the Effect of Self Induction . . ." (4 pages; Edison's hand).

20) Three pages of fragments from essays in Edison's hand.

The author of this work does not propose to merely reproduce on its pages that which has already been published upon this subject nor to describe elementary electricity (Law) nor is it the purpose to put before the public a collection of elaborate and difficult problems in electricity But the object is to simplify that which appears to be so little understood upon this subject: The author proposes to do this by presenting to the public in this work a series of experiments as performed by him: Having been for a number of years actively engaged in experimenting in telegraphy and electricity in general The author also will explain numerous observed phenomena in electricity they having been noticed by him and which is not generally known

1) "The author of this work . . ." (1 page; incomplete).

Notes (1874)
& Ideas for Book -

Where very delicate currents are used to move the armature lever of a relay the magnetic Effect of the passage of the Local Current through the local points will stick them together by using a high R Battery of Two Cups. a Single 1 Cup for the local Circuit. Signal at 30 words per minute were recorded or read on relay a very delicate relay worked by 2 Cells through a high Resistance - When two grave Cells were substituted for the two Daniel in the local Circuit the

2a) "Notes & Ideas for Book." (3 pages; Edison's hand).

No ~~signals~~ intelligable signals
Could be received the magnetic
Effect of the powerful Current
passing through the Contact
points was greater than the
~~retractile force of the spring~~
~~receiving~~ Effect of the
Current passing through the
relay.

add 11 Nov 72

The British Govt of Dept
refused permission to use
a grove Rattling on the Ex.
Lines

3

Try Resistance with Mirror Galvanometer of a Glass Tube filled with finely powdered Peroxide of Iron also with powdered peroxide of iron.

not Enough force to the Coil to overcome the angle of X & work it

2a) "Notes & Ideas for Book." (3 pages; Edison's hand).

No 1

Notes
and Ideas for Book

Where very delicate currents are used to move the armature lever of a relay the magnetic effect of the passage of the local current through the local points will stick them together by using a high R Daniel battery of two cups for the local circuit Signal at 30 words per minute were read on a very delicate relay worked by 2 cells through a high Resistance — when two grove cells we substituted for the two Daniels in the local circuit no intelligable signals could be received the magnetic effect of the powerful current passing through the contact points was greater than the effects of the current passing through the relay — add More

The British post office Department refused permission to use a grove battery on their lines

Dry Resistance with Mirror galvanometer of a glass tube filled with finely powdered Sesquioxide of iron also with powdered peroxide of iron

Not enough force to the water to overcome the angle of X wash it

2b) Transcription of (2a). (1 page).

No 1 Notes [COPY- ORIGINAL BY T.A.E.]

neutralizing Escape Show Kromers Method in a new form
Show Smiths arrangement in good form Show 3 modification
of my, Wh arrangement
Say Broadley gold plate rubbed with cloth will Electrify the
needle and cause it to stick to metal circle May be
discharged by lay the flat of the hand on it- Show good cut
also separate cut showing coils and needle (Ref—
Polarized Relays the line being polarized by a small constant
battery, M. C – etc – clockwork battery charger for —
cut and discreption Watkins – burgelar Alarme 1 dozen
good escapements, 2 or 3 good unisons Self Starting
regester Regester Repeater by lever and embossed paper
Dolph – having Sending receiving his own writing back
My two ways duplex Cut and discription with way stations
discreption and cut My battery also results of Experiments
on preventing of diffusion if that is not so then the reason blue
Kept down cause the action takes place right at caplon and
blue Vitriol used as fast as it tend to rise where in old
Magnets no action takes place on arising fluid but way
down at bottom Test that Spring pulling with and pulling
against Explain why That induction be greater on Lines
where poles dont make good Earth for in that case the
distance from one wire to the other goes over the same
material that it goes to the ground hence if the pole

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

be very dry and makes good earth on closing conduction
Takes place across the arms but quickly cease
owing to the polarization of the contact part of the wire by the
Moisture of the wood this would Explain the great
induction on the overland wire running through dry dust
one of the reasons why receiving on a ground wire is not
uniformly successful is because of return currents from
other wires which which when Exactly Equal work the
relay open when distant Man closes and when not Equal
reduces the Effective working Strength of the distant current
Secondly to the variations of the return leakage owing to
the meanness of the feeding batteries this cause of bad working
in Duplex balances the leakage is done by the plan now used
but not on Duplex I was told at Greenwich that Earth
current on A cable sometimes potential so Daniell cells
changes from N to P sometimes in less than ½ minit

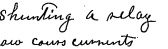
Spark due to a great number of magnets in circuit
may be apparently annihilated by putting square foot of
tin foil Each etc etc placing thick pieces of paper
between armature and Screwing magnet up close so as
to get core near armature and use powerful spring
of paper get very feeble Signals
painted platina points make better

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

contact and longer than flat ⊐⊏ because in this case that oxide has a clearance but with flat points it has not -

Compressed platina hydrolic on very hard drawn gives less spark best for inst. convenient Idea that Sounder points close circuit better than relay etc gold-leaf 4pt etc - show loss of part of Signal by Changing line

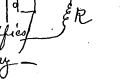
Why Spring points should be used about rebound of all Keys - proved by the quick fall of Currents Generating and break in induction of magnet in bridge showing ——— when held in full power with spring light ——— bad Connection in revolving shaft - Vibrating points best Compressed are Sounder use Secondary battery Induction of Condensers cable Leyden jars Secondary Chemical action At Cable



Say chemical recorder Splended instrument for investigation by comparison

Secondary battery shunting a relay

Discrete effects show cross currents



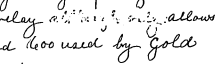
= and this

Automatic Plan of putting number way office on wire and get Signals from main Relay -

 "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 4

Work up System of Regeater repeating so as to combine
numbers of branch offices with main offices message received
Embossed and transmitted one main wire from Embossed Strings
Say peculiar strong paper used and peculiar high imbossing
– Say old G. and S. Relays although only $\frac{1}{T}$ long retarded
Speed waves Anthony Short Slotted relay [illegible] allows
of nearly double no waves be used 600 used by Gold
and Stock Effect polarized yet not.



See if in movement prevention
of acting by Vibrating P and
reverse coils double in Electromagnet shown resistance coils
of Kansas Stone and plumbago graphite also in glass
hard rubber Etc = mention where a wire may get
grounded through local connections with battery or
floor damps place office were for local running in damp
walls over gas pipes Etc = Some magnets used at
Louisville having a total length 11 inches worked bad on
dry day Say nothing of wet day secondary battery action
on land wires How working with a heavy battery
through a weaker opposing battery gives weak currents in
closing – P and A test Dec 27
Compensating Defects of reverse Currents where strong
enough to fully clear the wire and give an Excess –

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

My Relay worked by Duplexing the polarized and working from the discharge of the Magnet –
Why a polarized tongue should lay horizontal instead of perpendicular

Woods Buton	dots & dash marks can be burned in
Authon Buton	potential at the rate of —— per minut
Hicks old	by using a platina wire and keeping hot
Hicks No2	by battery (Horn) Register may be used for
Hicks latest	perforating paper next to platina for cases
Bunnell	Nickel – in most instances it is as good as
Hasken	platina and very much cheaper
M Wilkins	It is used for contact roller in perforated
	paper transmission and gives good contact at

3000 words per minut

This discharge from the Magnet in a wheatstone receiving instrument with the Spiral shown chemical records – The reason why the Spark is so much greater on a local current with a grove or carbon battery change with a Callaud of the Same Strength is owing to the greater internal resistance of the ——— by short circuit a mane telegraph battery composed of grove or carbon battery we obtained a dazzling Electric light but if 20 ohms or even less be inserted as a part of the Short circuit wire the Spark is only just perceptable – This extra resistance

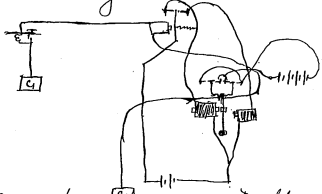
3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No. 6

is instrument in the Morse line for local circuits in different apparatus when a great number of contacts are made the Calland should be used movements—

Paper head if

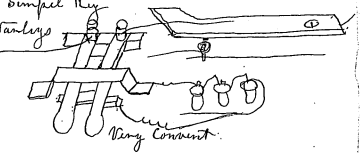
Method of getting reversed on a line at one station when form one battery at the distant station



Paper - P 19 - to make ordinary Redfluid - 1 gallon Sala 8 gal water in Separate Vessels dissolve 5 lbs Bichro in 2 gal boiling and add to the Strength through the preparations of potash Sometimes made ⅕ greater to make a more granulizing fluid add one gallon water Saturated to one gallon Sul a

Simpel Ky

Reversing Ky



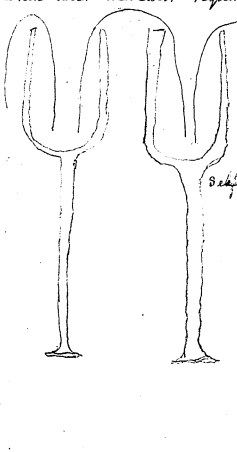
3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 7

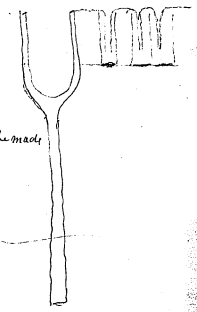
Very weak receiving currents Sometimes the permanent magnetism is equal to received currents in that case the relay opens when Key closed & Reversed current translator Left in open ckt separates several RR signals get disruption from spring

Test battery

when better insolator required This



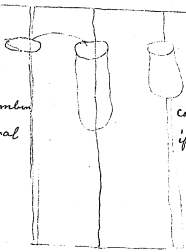
or



Study if can be made

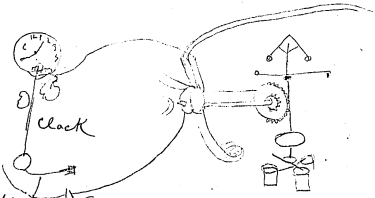
No 8

Simple Galvanometer



get good coil of Amen combin instrument Phelps good Sp[illegible]

connected see if Rods work



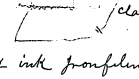
Laurants Self adjusting Relay Siemens polarized relay
Thomsons Munson good reversing Key Self closing Keys
Van Hoevenbergs unison Van Hoevenbergs rattler Sounder
Switch boards all Kinds Meantime when testing long magnets
dont shake floor to increase Electricte battery get bad results
dont test magnets within several feet needle

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 4

mention proposed by little weeks Signals so as to not
Show Static – say how works but this already done by
_____ will bring little results – Some persons adds
condenser best this increases instead of augmenting it –
Experiments made between W, T, N, Y. gave highest best
90 w per minut on mast Sensitive iron paper that was
readable good rain produces his results in long currents –
have a half current should be sent for dashes
How first part of letters should be longest 0000
How Speed increased by using European Alphabet and
close Spacing

Show results on paper where it is attempted to work
10 until _____ Duplex showing automatic perforated
paper Duplex My perforator all new –
Modification by Jackskell Man Roman perforator
old paper feed. 3 Key perforator. Combination to
produce Morse characters Etc roman Embossing 45 Lever
printer chemical printing machine Milwaukee Copying
machine



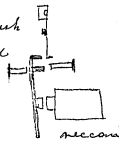
Thick ink from fillings

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 10

artificial Cable — artificial cable with magneto
artificial " with Secondary battery gives
Experiments and recorded results with all — Bradleys
Spools — best of Strength compared with Siemens R.
Duplex Steamp may have way stations secured by
using a very short relay shunted = and the current from
the Stations Sending is double Strength of the other
current — Duplex — be best when relays
arrange cut for that a Relay is best with

Sparing points this
Gutta percha throte Varnish
to coat arms of grove and
other zines in place of
asphaltum which



Spangy try it asphaltum recommend by paper
oil on Collard battery resonance — wooden core prevents
Evaporation Effectualy — to make carbon battery last
long which provids part ½ inch thick — try
where there are Several magnets in them Some Circuit
whose — one vibrated rapedly the Stoppage of
any one of these — is liable to alter this
adjustment of the rest
Resistance of leakage being water and subject to
polarization is decreased but pitting on battery

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 11

X hence when every thing is Equaled for the taking off of X will take off a Electrometive force off of the water leakage

so that when the distant current comes through not so much will pass via water leakage to Earth as through metal leakage but when X it it breaks down the resistance of the water drops denovations X although equaled move of the distant current will pass through leakage owing to the peculiar Effect of X in reducing R of water the advantage of A — Jermenk current is that the leakage on cross fire generally all in on dentation when as other English lines we receive Cessents in both direction so that we a cumint between Nil and 30 Elements and on the English lines between between 30 positive and 30 negative on a disturbing effect of 60 Elements

—

will always be a drawback to fast systems

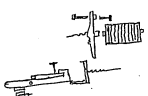
Excessive underground work as well as the close proximity of one wire to another and the use of cotton wires to prevent cross currents to all of which are in use in England render them System far inferior to the american — say about Static change increased

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

follows that the current will devide Equally apon the regular and artificial line and move 1
Yass down the receving instrument as the resistance on both
Sidis an equal and there is no cause for a difference
of L — if no Condenson was connected to the
artificeal line that portion of the current due to the
Static charge of the line would Yass through the instrument
This resistance of the artificeal line can be reduced to less
then the resistence of the line and the difference compensated
for by increasing the resistence of the Rheostat B. but the
decrease of resistance between the one armature of the
Condenson and the other of course decreases the Electrostatic
Capacity of the artificial line, & when Signals are received
the distance station more then one half of the current passe
through the coil A, to the Ground Via H the other portion
through the relay thence through B B the ground and a
Small Yortion through a to the ground when the Signal
crosses the induced current from the magnet circulats within
the circuit formed by A B C. Thus preventing the
instantans charge and discharge of the relay and
mutelating the Signals in the exact proportion as the length
of the cores of the magnet and number of the Convolutions
are increased and the resistance of the devinced circuit. This
Effect is Yartially compensated for by the slight changes

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

which are generated by the small quantity of which passes to the ground through D, Mr Stearns is the inventor of another very ingenious modification which is shown in figure —

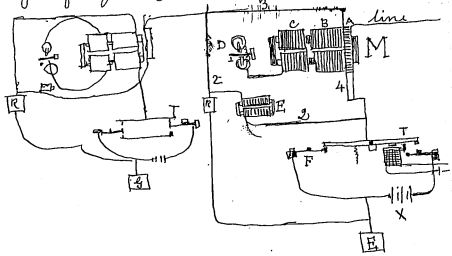


the effect of the outgoing current in this method is compensated for by mechanical means a, is a lever B, a retractile spring having a Tension equal to the effort magnetism on the relay due to the outgoing battery this lever comes in Contact and rests on the Extension of the relay lever when the Sounder lever raised and at the instant the contact points seperate and the battery BC is thrown on the line the advantages of this method is that if the Equation be not perfect no extra Signals will be thrown in as in the double Coil duplex but the Effect will be to require the spring X to be adjusted frequently Mr Stearns discoveries no method of counteracting the Static charge This charge may be counteracted mechanically as shown in fig

the following methods were devised by the Author and are on illustrations of the Enormous number of Combinations which it is possible to make with Telegraphic apparatus a portion of them have

 "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

Serious defects while others are while others will perhaps be found as more perfect than the methods now use the method which I shall now describe is worked inbody by induction which requires less perfection of balance and has a greater working margin besides allowing the use of apperatus which is nearly self adjusting this method shown in figure



M is a long Electromagnet upon which are wound the coils A, B, in opposite directions on to another the coil A is in the main line circuit and the coil B in the artificial line R, is the resistance coil adjusted so that its resistance including the coil B, Equal to the resistance of the line C is an extra coil not in connection with either circuit the

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

line free ends of this coil is connected to a polarized relay O
E is a long Electro magnet with the armature in
permenent contact with armature cones, and is connected
so that that por portion of the current from the battery
X which passes into the artificeal line, divides half
passing through the Coil B and the other half through
the magnet E, when the Sounder Lever is actuated by
closing the Key R battery X is thrown on the line were
the magnet E, disconnected and there were no Static
Charge on the regular line the two coils A B would
balance Each other and produce no induction current
in coils C, but if there was a Static Charge on the
line the balance would be destroyed the cones of M
would become magnetic in proportion to the Strenth of
the Static charge This would induce a current into the
Coil C actuate the polarized relay relay but if the
magnet E, is connected the current which passes through
it sets up an inductive charge which circulating within the
circuit formed by the wires 2, 3, 4 produces an Electromotive
force in the Coils B, Equal to that produced by the Static
Charge in the coils A the coils A, B, being balanced
are const themselves producers of induced elements when
the line is very Short the magnet E, Should be Short as in
that case the regular line sends Short charges while

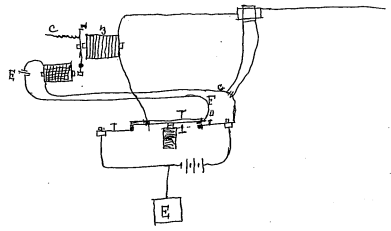
3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

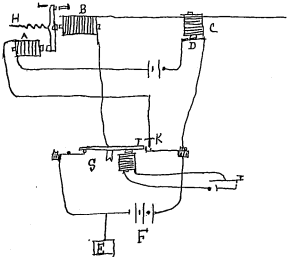
the magnet does the same thing all Effects of the outgoing battery are balanced and the induced Currents generated in the Coils S. actuating the polarized relay are due to the Excess of Current from the distant Circulating in the Coil. A, when the Strength of the distant current does not fall below a certain point the polarized relay, H, is self adjusting & receiving being worked by the inducted induced Currents above and independent of their Strength except they fall below a certain point

the Magnet E. is infinitely more powerful than a Condenser in proportion to size and cost and Convenience the author believes himself to be the first person to discover the merits of an ordinary Electromagnet for compensating Condenser in telegraphing the numerous successful applications which he has made of it a clearer description of the induction Effect of the Magnet F may be found in the chapter relating to Magnets

The next method is shown in fig and consists in Equating point by the joint action of an Electromagnet and retractile Spring

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).





3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 19

The Sounder Lever connects and disconnect the battery, F, in the usual manner on additional point, K, is added to that which point the local circuit is broken, when the battery F is put to line wether this Local circuit one two magnets A, and, D, The Spring H is adjusted so that the lever will respond to the distant Signals, when the Battery, F, is to line and passing through it were the battery, F, taking off the tension of the Spring would have to be decreased in the Exact proportion as the strength of the magnet, B, was decreased by disconnecting the battery, F, to get the distant Signals but at the moment that the battery, F, is disconnected the local circuit is closed and the strength of the magnet A is produces as force acting in the opposite direction to the Spring upon the lever the magnetism in this magnet is Equal to the magnetism which had been power in the magnet, B, due to the battery F hence by the joint action of the Spring and local magnet the lever is always adjusted for the distant signals The magnet, D, also in the local circuit is acts as the primary coil to the Coil, C, which is in the main line, at the moment of putting on the battery, F, the local circuit is broken at the point K. The Core of D, discharges and an induced current is thrown into the coil C, and on the line Equal to and in the opposite direction to the static charge and when the battery F is

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

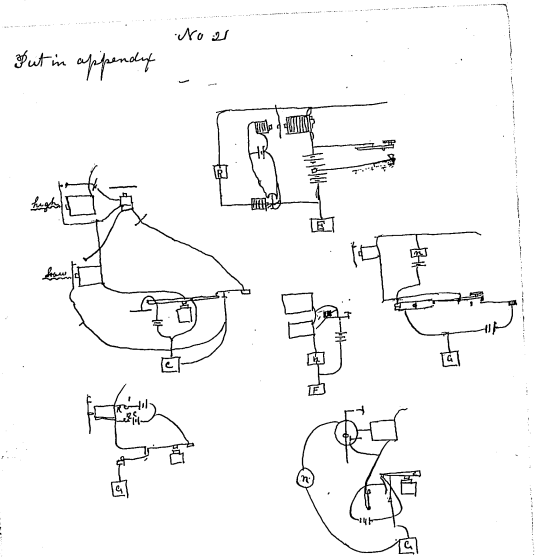
disconnected the local circuit is closed and a contrary charge is induced into the coil, C, and main line equal to the returning static charge in this case the charge is not balanced upon the receiving instrument as in other duplex but neutralized upon the line itself of course this acting up on the whole line neutralizes the charge which runs out at the other end which alows the relay at ~~ether~~ end to discharge — and of cause give better Singnalling in fact is duplex the charge which runs out at the receiving End tends to shorten the first part of asignal and lengthen the last part but this is prevented by compensating in this manner. The Strength of the inductive charge thrown into the Coils, C, Should be so regulated that it will just neutralize the Static charge and give no Excess otherwise the distant relay will close a second time and it will also effect the home relay by increasing the coils in the local circuit inductive discharges of the most powerful character may be thrown upon the line to compensate for the discharge which occurs on long well insulated Circuits=

~~But in a profunday~~

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 21

Put in appendix



3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

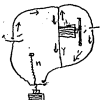
No 22

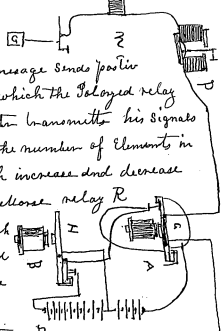
Get Copie of those already patented - discribe duplex arranged on a cable - duplex for Local circuits duplex a Comon & A S joint line inst the English reverse Current way of using Sterns duplex. The author has taking great pains to test the several Methods of transmitting two messages in the same direction upon one wire at the same time discribed in Schellen and others Standard Telegraphs works but no one of them will give readable signals Even in the laboratory circuit it is very questionable whether more theoretical instrument Combination should be inserted in a Standard work of Telegraphy always insurmountable obstacle the problem to be solved producing a practical Combination of this class of duplex is very difficult to Solve as will be readily acknowledged by those who have attempted it This Value of this form is greater Cas than the ordinary duplex on for instance between N York and washington where the the great bulk of the business is in one direction and on press work it has another value which is that it can be doubled and form messages transmitted at the same time the author has devised a plan of Sending two messages in same direction which although it is not him Extensively introduced works very successfully he has also had in successful operation in his laboratory

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 28

a quadruplex plan of which is shown in page
in the latter instrument a slight modulation of the
Signals take place owing to self induction but —
will probaly be found found for this end=
fig — gives the single method





one operator transmitts a message sends positive
and negative currents to which the Polarized relay
P responds the other operator transmitts his signals
by increasing and decreasing the number of Elements in
the Signalling battery which increase and decrease
shows itself on ordinary Morse relay R
the Electro Magnet A which
local circuit opened and
closed by a Key actuates the
reversing lever B, which
puts the P or N pole of battery B
to line as it is attracted or drawn away from the Magnet
A — the Signals from this instrument recording upon the
polarized relay P— B— is another Electromagnet also in a

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

local circuit opened and closed by a Key. This magnet actuates the lever, H. which increases or decreases the number of Elements of the battery, B. the Signals from this instrument are recorde on the ordinary relay, R, it will be noticed that the local battery whether it be 20 Elements to 70 Elements is reversed by the lever, N. the polarized relay, P, will respond to the reversals of 20 Elements on circuits of several hundred miles in length owing to the fact that it has no retracte Spring to over come and the lightness of moveable parts it will not change its adjustment when the number of Elements are increased to twenty hence the Operation of the lever, H, will not Effect the Signalling due to the reversals= The relay R requirese a greater force to set it in motion the armature is adjusted to such distance from the cores that the twenty Elements has no Effect upon on at least scarcely a perceptable Effect when the tension of the Spring, S. is the least which it can be made if the Spring, S, be adjusted properly This relay will close and open Every time the 150. Elements are added or Substracted from the battery, B.

it obvious from the above discription that the Signals due to the reversals will be recorded upon the polarized relay P and those due to the increase & and decrease of the Electromagnetism of the reverses will be recored upon the relay

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

, R, but it by no means follows that these Signals will be perfect - The relay R must be of a peculiar character and and a particular arrangement of the local circuit and Saunder must be wade - to overcome the difficulty Experienced at the moment of the reversal of the battery this difficulty which I Shall now discribe was one of the great difficulty Experimenting in the Course of Experimenting when the lever H of the magnet, B, is depressed permantly the armature of the relay, R, is attracted - if now while, H, is Still depressed the battery B is reversed by the lever C, the polarity of the iron cores of the relay R, must change from N. S. to S. N hence there is a instant where there is no attraction Power in the magnet the armature lever if the relay were an ordenary one would be pulled away from the face of the Cores by the retracting Spring for an instant and be immediately reattracted against when the change of polarity had taken place this would open and close the local circuit if arranged in the ordenay way giving a false signal as this takes place at every reversal it follows that the Signals would be greatly mutilated - this is obviated by Shortening the length of the magnet So that it changing and discharging time Shall be Several times less than the ordenary magnet and increase the charging and discharging time of the local magnet - when the magnet

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

is very short less than one inch ± The polarity of the iron cores will change with such rapidity that the armature scarcely leaves the face of magnet even when the spring S. is adjusted so high that signals are rarely recorded and additional protection against false signals is the manner of closing the local current on the back point instead of the front point when arranged in this manner the armature must fly back and rest for an instant on the contact point before it will open the sounder magnet and then will nearly happen Except upon very long circuits of considerable Capacitance the Static change increasing the time of the change of polarity but which comprise them is possible as well be presently shown Two locals batterys are connected to the local sounder the 2 iron poles of one battery is connected to the copper poles of the other battery the sounde is placed in a bridge wire which forms a point of both circuits by tracing the direction of the current when both circuits are closed it will be seen that the bridge were is at zero point this being no difference of potential necessary to cause a flow of Current through this wire consequently when the armature of the relay R. is in Contact with the back point both circuits are closed and the sounder is open when the armature is attracted one circuit is broken the balance is

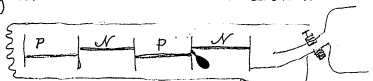
3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

destroyed and the Sounder closes passively as if there
, There were but one battery and the contact was made
on the front point = The fact that the Sounder is
allowed to rest then a closed circuit allows the self induction
to react upon itself and very slightly prolong its time
of charge and discharge as has been described more fully
in the Chapter local circuits the Cores of the polarized
magnet P Should be very short and the magnets shunted
with high resistance so as to prevent the self induction
current going upon the line interfering with the change of
polarity of the relay R, = were the Cores of the polarized
relay of the ordinary length the discharge from them
would weaken the first part of every reversed current and
were it to be shunted to prevent these currents from
interfering with the relay R, the currents circulating
within the shunt would be so powerful that a
mutilation of the signals would take place on the
polarized relay but by decreasing its length the self
discharge can be so reduced that it will no longer
be perceptible = reversed currents sent upon a circuit
upon which end static change takes place is recorded
upon chemical prepared paper thus | P | N | P | N |
the vertical lines shows the points where the relay R, is
liable to open and close

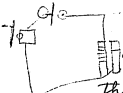
3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 28

long cones the current is recorded thus



or when the relay, R is short and the polarized relay, P has long cones some effect is produced, — but when both are very short then the marks do not show any perceptable weakening the same weaking of the marks shows itself when the record is taken up on a very long line of high induction capacity the first part of positive current being with the induction charge due to the previous negative — when this apparatus is to be used under the latter condition — the ETC Etc



see if it will —

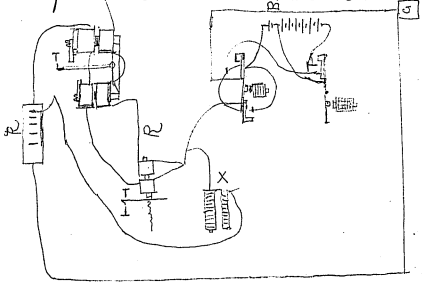
ETC

the alteration to be made with this apparatus to make it a quadruplex (See if if proper) is to combine two sets together with double coils on each magnet for balancing the out going elements upon the receiving instruments figure shows the connection at one station only arrangement at the other station being precisely similar I have separated the coils in the magnet so as to simplify the connection

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

the relay, R, and P, being provided with Equating coils placed in the artifical line formed by the rheostat, R - and magnet, X. (the latter for compensating all Effects of the manipulation of the battery B can be neutralized on, R, and, P. Shown former duplex Key and insert in right place -

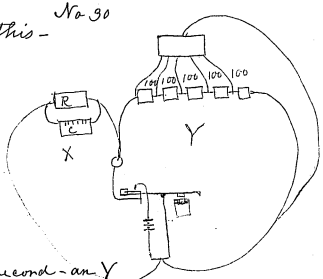
This induction action of the currents from the distant station thrown with the artifical circuit by the double coils renders the Signals at certain periods of Time when the four Keys are being operated rather shaky but in line This defect will no doubt be remedied -



3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 90

Try this -



See if X dont record - an Y

Mention that Garret Smith one of the chief Opps of the W U Telegraph office in New York Succeeded in applying the Steam duplex to A Combination printing which worked very successfully between New York and Philadelphia - Chemecal Paper

In the investigation of the Static charge upon telegraphic circuits the chemical recorder is of great value in fact many of the phenomena attending these discharges can only be investigated with this instrument it gives reliable records of changes which takes place with great rapidity it is also of great value in determining the induction of magnets and is as yet the only means by which a near approach of the capacity of a circuit can be obtained great difficulty was first Experienced in obtaining a chemical Solution

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 31

which should have great delicacy and still give marks of a permanent character paper prepared in a Saturated Solution of iodide of potassium in which Solution there is a small quantity of flour and Nitrat Soda — is Extremely Sensitive to the Electric current giving a perceptible mark with one cup of battery through a Resistance of 600000 ohms but the marks are not permonent great draw back in Experimental investigation — ferrocyanide of potassium with Nitrate of Ammonia as given in Culley and others combination of ferrocyanide of Pot with other Substances described in Telegraph works are infinitely less delicat than the Iodide of potassium there bean about the proportion of 40, to, 1 — besides a polarization of the pen takes place with the other Solution which tends to give capaceious results..

The author formulas now used by the American telegraph Constructs and in co gives paper of the greatest delicacy who made in the proper manner the marks are of a permanent character and bear points of delicacy to iodide formula 2g 3 g ii to 40 Tourmula water double Chl of Gold and Sodium from on Tin pan Etc Etc direction the Auchloride of Sodium is a very Expensive Salt but as little is used the rolls of paper costs but little more than the ferrocyanide paper and several times less

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

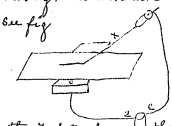
than the Iodide of potassium paper – the wet paper will have a light yellow color and the mark will not be of a rich purple and very permanent no polarization of the pen takes place with this Solution –

an other formula possessing nearly the same delicacy and much less expension and which gives marks if a permanent Color is 1½ ounce of the ferrocyanide of potassium
one gallon distilled water 1 lb of chloride of Sodium
Stirred until dissolved not

the ferricyanide of potassium, is a salt which it is one difficult to obtain at the drug warehouses may be made from the ferrocyanide Of Pot
This Salt is not decomposed by light and paper saturated with it will retain its active Keep moist for any length of time if placed in a Closed jars prevent evaporation after it can be used immediately often immersion in the solution but clean marks will be obtained after the excess of fluid has been evaporated and the paper is just moist to the touch = formula No 3 water Logwood Chl S – Etc
This Solution has a delicacy as great if not greater than the prussiate of potassium paper and gives permanent marks but has the drawback that after a short expanse that Logwood is decomposed and the paper nearly the same Shade of color as the original marks formula 4
1 – water Chl — a Solution of cochineal freed from fat by digesting with Ether
This formula is very delicate gives marks of a permanent

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

Character but the marks do not show plainly as other formula owing to the deep color imparted to the strips by the Coloring matter of the cochineal= formulas 5 pyrogallic ac. formula — 6 Sulphuret of pot discribe formula 7 hydrosulphuric acid discribe 8 hydrosulphat Ammona - discribe - These formulas on the results of an immense amount of Experimentation The Author laboring under the load of a very small knowledge of chemistry at the outset The principle of chemical recording is this if a current be passed through an iron wire on paint resting upon paper moistened with water See fig



which formed of two atoms of hyp. hydrogen and one of oxygen the water is decomposed the hydrogen on the plate C and the oxygen at the point where the wire X, comes in contact with the paper — this oxygen being in what is called nascent state of oxydize the iron performing the first oxide or protoxide of iron

this oxide is white and will be imperceptable, if the paper is Exposed to the air for a very short period of time the first oxide or protoxide absorbs more oxygen from the air when its nature is changed and a new and entirely distinct compound is formed, called the Sesquioxide or peroxide according to the length of time the paper is Exposed to the air the protoxide is always formed at the first instant the current is passed through the paper Note bodies which have just been set free from one combination have more powerful affinities than when already free

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

Providing the metal used in oxydizable — if none instead of using water the ferrocyanide of potassium forms a pearl of the solution — which is recommended in nearly all Standard works on telegraphy the ferro ferrotoxide would not combine with the ferrocyanide of potassium to form ferrocyan blue & hence the prostoxide has been changed into a higher oxide (E) iron with in combination with iron three 1 atom of oxygen) as this takes a small period of time it follows that if the wave follows each other very rapidly that there will be no time for the higher oxidization to take place hence at the propitious moment when the oxide is in a state to most powerfully enter into another combination & finds no substance with which it can combine until it has been free for some time then it enters into combination to form ferrocyan blue but very slowly and the results are in favor another effect takes place which is that the protoperoxide is formed upon the surface of the iron relays and where it finds no salt to form a combination so as to free it forms the film by slight pressure the particles of the oxide cling with intensity to the iron & are spread over the surface of the film to a greater extent than if it could combine at the instant it was formed

two openings . of paper one moistened with iodide of potassium the other with ferrocyanide pot and mark A placed side by side recorded at a given speed thus Iodide — — — — — — — — — —

Ferro. — — — — — — — — — —

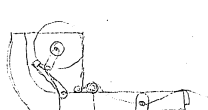
it will then be seen that the ferrocyanide of potassium does not combined with the first oxides formed by electrodecomposition hence it has little or no delicacy and is worse than useless either in experimentation

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

on Telegraphing it is obvious from the above that some Chemical which will enter with avidity in Combination with prodyde of the metal which combination has a conspicuous colouration thus Ferri Chloride of Sodium is Logwood ferrodyanidi of potassium Cochineal Prussiate Etc are such salts in the case of ferri chloride of Sodium the gold combine with Cl to form the purple of Cassius with ferrodyanide of potassium it combines with the prussiate formed by decomposition of the water to form Turnbulls blue Sulphocyanide of it the hyposulphite combines with the prussiate of iron form the Sulphuret of iron all of which are insoluable in written and cold dilute acids were they Solvable the marks would not be permanent - the peculiar action of the native principle of Logwood and Cochineal with the prussiate is not so clear The Author has noticed several compound Solution of his Experiments the base of which were organic matter which was more Sensitive to the Electric Current when when there the most delicate mirror galvano but the marks were the most fugitive Character for then Experiments will probably given a permanency to one or more of these Solutions the Value of which in automatic Telegraph cannot be overestimated - for all Solutions where the Styptic takes part in the Chemical - combination Considerable possession of the Styptic must be given on the paper so as to deposit the new compounds upon the paper and prevent mechanical dragging

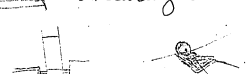
3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

out of the Signal thereby producing attenuation of the marks independent of the same attenuation produced by the Static discharge when the styles does not enter into combination for instance a platina and Iodide of potassium light pressure can be used without mechanical attenuation Chloride of Sodium or common Salt is added to all these solutions to reduce the resistance of the moist paper so as to augument the amount of decomposition the paper which is to be used is not a matter of indifferance fine thick well washed bibbles Cotton paper will give infinitely sharper and more perfect Signals than ordinary paper figure — Shows a very convenient instrument for winding the paper



it is receiving Etc Etc

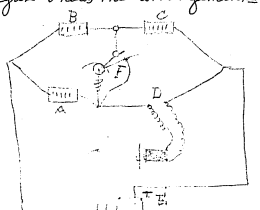
fig Shaw reel



Roughened milled heads prevent slack Etc hard rubber the Self induction of Electro Magnets the Self induction of Electro magnets is one of the greatest drawbacks to perfect

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

instrumentation in System in which they are employed the instruments what I used in the following Experiment was the Chemical recorder with two recording Styles resting on the paper which moved uniformly by clockwork controlled by a very accurate governor arranged in the bridge wire of a — bridge in one of the branch of which is placed the Magnet to be tested figure 8 show the arrangement=



any device which is suspended of generating induced currents or Secondary currents due to Chemical action may be inserted in the branch D.

The Branch A and B being Equal and the resistance of C, being made Equal to the resistance of the Magnet to to be tested upon closing the Key E, and keeping it permanently closed no current passes through the bridge wire F containing the chemical recording instrument but the current from the battery passes the branch C, and D, and A, and B.

 "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

That portion which passes through the branch, D, charges the Electromagnet F now while the magnet is charge the Key E be raised the current is broken and the induction discharge from the Electromagnet flows within the circuit formed by the wire C D and F this current will be decompose the chemical solution and record itself permanently one of the iron points. if now the Key E is closed and opposing induction discharge is thrown within the circuit formed by C, D, and F and is recorded on the other pen

Thus

without an ordinary relay of the Gillotson pattern used Extensively on the American Railroad telegraphs the record was made there by successive opening and closing of the Key F armature ½ inch from cores

Due to induction — closing — — —

Due to induction — opening — — —

armature in contact with core

Due to induction closing

" " " opening The following diagram will perhaps explain the action better

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

No 89

The resistance of the relay was 134 ohms total length of cores 5½ inches diameter cores 9/16 – diameter Spool 1½ – (See if correct

Second Experiment, Ordinary relay Phelps pattern used Extensively by the W U Telegraph Co – Resistance 134 ohms drawn Core ¼ – in coils – – – total length of cores 3 inches armature one quarter inch away

Due to induction closed – – – –

" " " open – – – –

with armature in contact due to induct closing – – – –

with a Special relay having 134 ohms Resistance with same dimensions as Tillatson Except length of cores which were but 2 ½ inches armature ¼ owing to induction closed – – – –

open – – –

armature in contact induction closing – – – – –

with a relay having but one Spool arranged as shown in fig with 134 ohms R 1 inch long core ¼ with armature in contact the induction was so short duration and weak that a mark was scarcely perceptable on the most sensitive chimacl his next Experiment was with a magnet of greater length the total length of core 10 inches diameter 9/16 – R 134 no armature – induction closing – – –

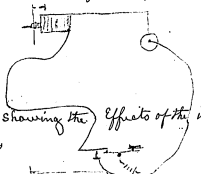
open – – –

with Keyper in contact induction closing – – – –

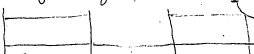
open – – – –

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

Experiments were tried with magnets having a total length of several feet from which induced current flowed within the bridge circuit several seconds after the battery had been disconnected A comparison of the different records made shows that the induction action increases at the square of the length of the magnet and apparently at the square of the distance of the armature from the face of the cores These two laws will account for nearly every deffect in Electromagnet instrumentation The number of convolutions increas the amount of induction as well as the mass of iron but if the proportionate increas of convolutions and increas of iron is made on every magnet the records ~~magnets~~ still show the ~~truth~~ of law of the Squares — are sent through as if the Tillatson relay as shown in fig—



The record will be thus showing the effects of the induction in mutilating the signals



The induction due to closing the circuit does not show to the same extent as that due to opening but this can be explained that in this case the whole power of the current is used to

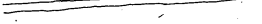
 "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

over-come the charge, whereas in the bridge there were 2 coils
it a route free from induction influence hence the opposing
Electromotive force of the indirect current balances it in the wire
2 hence no interference with the induction takes place in the
bridge This diagram may explain the dashes better

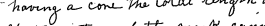
if the armature is adjusted one distance
away from the face of the magnet the record will be This

Sent
Rec'd

if a very long magnet is inserted in place of the Telephone
the record would be Thus Sent
with ordinary morse writing at 10 words per minute the
record will be Sent



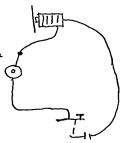
at



when a magnet having a core the total length of which is
less than 1 inch attenuation of the mark cannot be perceived
See about putting in several and increasing the battery in
proportion as increased R See how will Effect it if the
relay is arranged as shown in the following diagram no effect
from induction Except on closing is Experienced

 "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).

as there is no current for the induction to discharge in when the Key is opened and the record will be

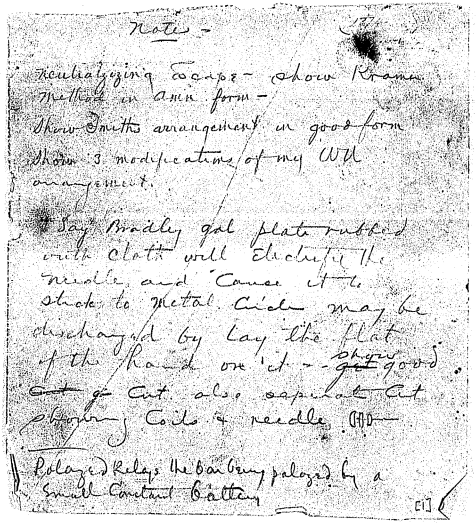


Sent — . ---- . -- ---

Received — ---- -- ---

It must be remembered that when the current is Sent through an Electro Magnet the induced current generated is in a contrary direction to that current and in the same direction on opening

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).



Note -

Neutralizing Coops - show Rham Method in ann form -

Show Smiths arrangement in good form

Show 3 modifications of my WU arrangement.

Say Bradley gal plate rubbed with cloth will Electrify the needle and cause it to stick to metal. Cicle may be discharged by lay the flat of the hand on it - ~~get~~ good ~~cut~~ ~~of~~ Cut also capulate Cut showing Coils & needle (HD—

Polarized Relays the bar being polarized by a Small Constant Battery

[illegible]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

MCC – UC – Woodwork Battery Charger
for Exchange Cut & descriptive
Watkins Alarm –

Ann Dental regular unit
" " Burglar Alarm

1 doz goods & accessories.
2 or 3 good unions
Self Starting regulator –

Register Repeater by lever & Embossing
paper –

Duplex – Having Sending receive his
own writing back

My two Ways Duplex Cut & descriptive
with Way Stations.

[7]

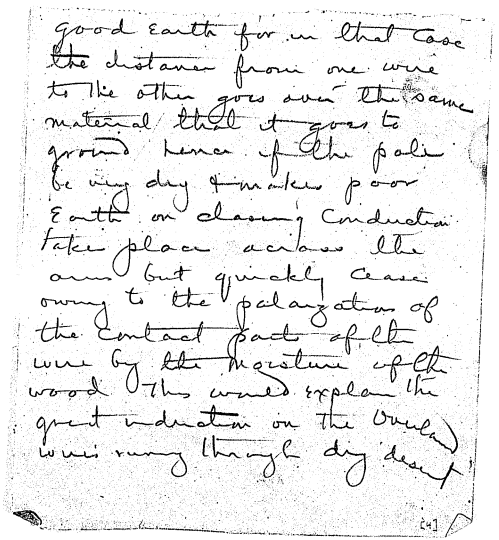
3b) Pages 1–11 of (3a) in Edison's hand. (38 small pages).

Description of Cut My Galley
also results of experiments on
prevention of diffusion of Chat
not so then the reason Blue
Kept down Cause the action
takes place right at Copper &
Blue Vitriol used as fast as
it tends to rise where
the in old way no action take
place in mixing Blend but
way down at bottom

Test that spring pulling with
spulling against Explain Why
That induction be greater on
Lines whose poles dont make

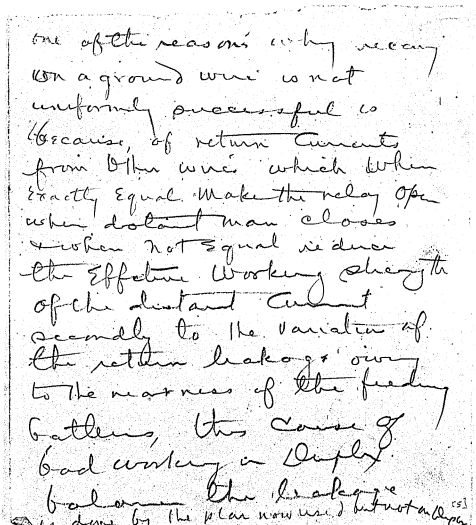
[3]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).


good Earth for in that case the distance from one wire to the other goes over the same material that it goes to ground hence if the pole be very dry & makes poor Earth on closing Conduction take place across the arm but quickly cease owing to the polarization of the Contact faces of the wire by the moisture of the wood This would explain the great induction on the Ocula wire running through dry desert

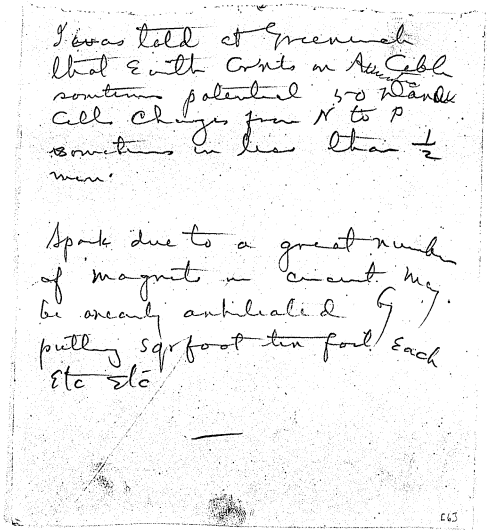
41

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



one of the reasons why recurring on a ground wire is not uniformly successful is because of return Currents from other wires which when Exactly Equal Make the relay Open when distant man closes & when not Equal renders the Effective Working strength of the distant Current Secondly to the Variation of the return leakage owing to the wetness of the ground Gathers, thus Causes of bad working in Duplex balance the leakage is done by the plan now in use but not in Use

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).


I was told at Greenwich that 8 with Coats in Atlantic Cable sometimes potential 500 Daniell Cell charge from N to P sometimes in less than ½ min.

Spark due to a great number of magnets in circuit may be greatly annihilated by putting sqr foot tin foil each etc etc

—

663

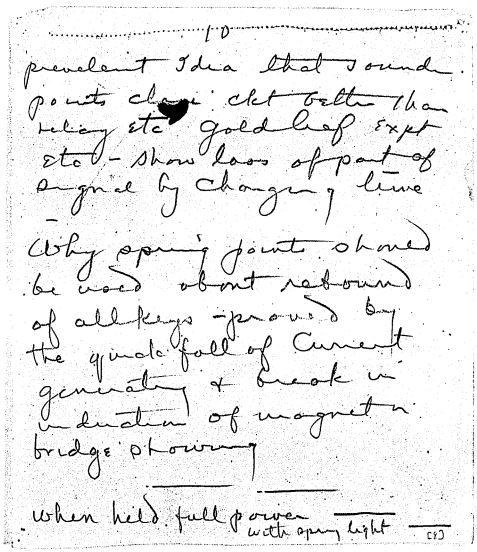
3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

placing thick paper -
between armature & screw
magnet up close so as
to get core near armature &
use powerful spring of pen
get very ~~quick~~ feeble signal.

>< pointed platinum points
make better contact & longer
than flat >|< because
in the case the oxide has
a clearance but with flat
points it has not -
Compressed platina by drolue
or very hard drawn gives
less spark best for use

[7]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

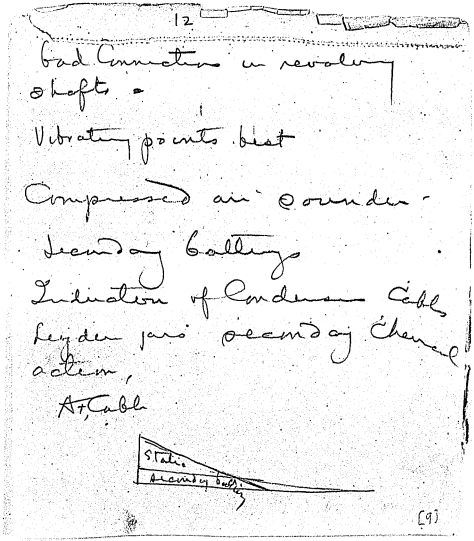

10

prevalent Idea that sounds
points change: clot better than
rubber etc gold leaf Expt
etc - show loss of part of
signal by Changing line

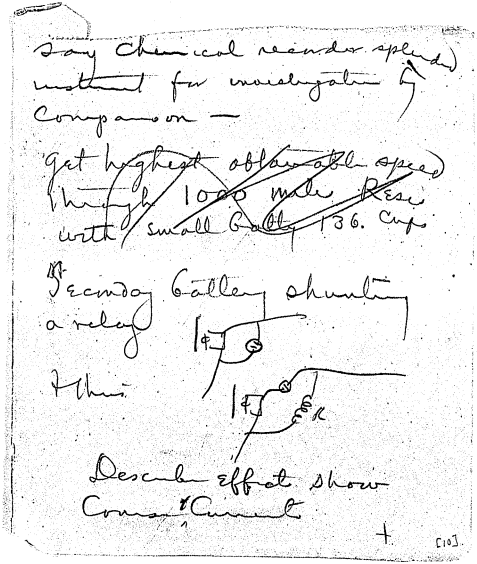
Why opening points should
be used about rebound
of all keys - produced by
the quick fall of Current
generating & break in
induction of magnetic
bridge showing

when held full power
with opening light

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

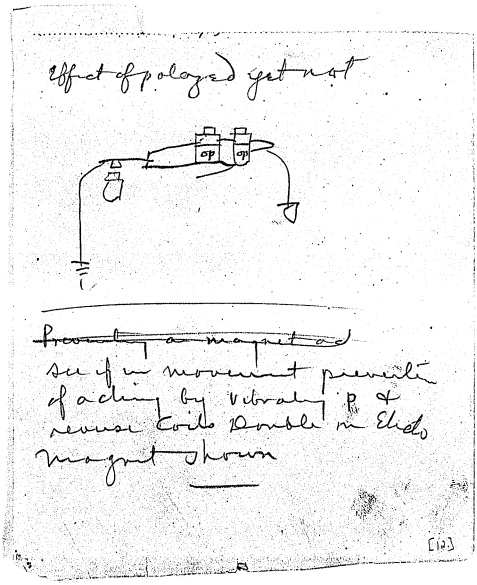
Automatic plan of putting number way offices on wire & get signal from main relay.

Work up system of Repeater repeating so as to Combine number of Branch offices with Main office messages read Embossed & transmitted over main wire from Embossed strip - say peculiar shape dot & dash and a peculiar length Embossing

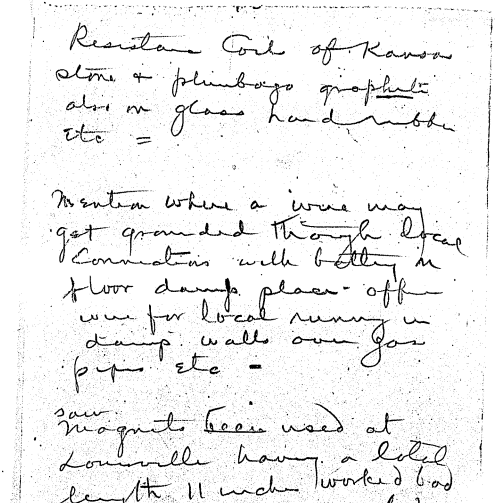
Say old G & J Relays although only 3/4 long retarded speed Wave another short Relay allows of nearly double speed no waves be used 600 used by Gould and Stock

[illegible]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

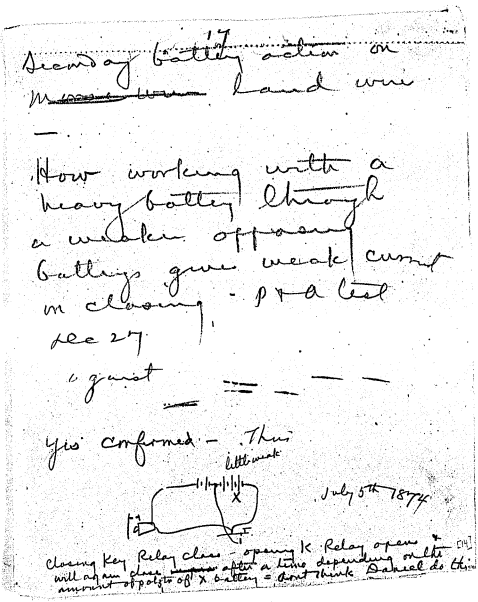


Resistance Coil of Kanowa
Clone + plumbago graphite
also in glass handle rubber
etc =

Mountain where a mine may
get grounded through local
Connections with battery in
floor damp place - offices
use for local running in
damp walls over gas
pipes etc -

Saw Magnetic Ores used at
Louisville having a total
length 11 inches worked 6 ad
on day day county work day [13]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

Compensating

Effect of reverse Current when strong enough to fully clear the core & give an excess -

Mag Relay Worked by Duplexing the polarized & wkg from the discharge of the magnet - also this

Why a polarized lamp. Armed lay horizontal instead of perpendicular

[15]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

1 9 1/2

Woods Bulton
Aulton Bulton
Hucks old
Hucks No 2
Hy Lalond
Bunnell
Hopkins,
Milliken

dots & dashes.
Marks can be burned in paper
at the rate of —— per min
by using platina wire
& keeping hot by battery.
(Horn) Rigsta may be used for
perforating paper

[16]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

Next to platina for contact Comes nickel - in most instances it is as good as platina & very much cheaper It is used for Contact roller in Autocratic perforated paper transmission and gives good Contacts at 3000 Revolutions per minute. 3000 = 60000 cranes

The discharge from the magnet in a Wheatstone receiving instrument with the speed of hour Chemical records,

[17]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

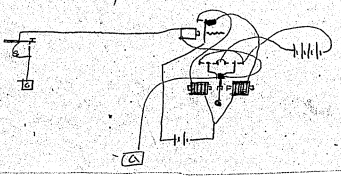
The reason why the spark is so much greater on a local circuit with a Grove or Carbon battery than with a Callaud of the same weight is owing to the greater internal resistance of the Cattin - by shortcircuiting a Main telegh Battery Compound of grove or Carbon Battery we obtain a dazzling Electric light but if 20 ohms or even less be inserted as a part of the short Circuit, wire the spark is only just perceptible - This extra resistance is inherent in the Battery,

~~For many instances~~ hence for local circuits in different apparatus where a great number of Contacts

are made the Collard should be used -

Movements - Pope had it thumb used on his Pk Signal

Method of reversing getting reversal on a line at one station when from the battery at the distant station



[193]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

Page - p 19 -

to make ordinary Re-fluid -

1 gal Sul A. 3 gal water -

in separate vessels dissolve

4 lbs Bichrom in 2 gal boiling

& add to other slowly stirring thoroughly

The proportion of potash

sometimes made ½ greater

to make a more quantizing

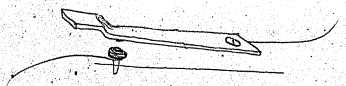
fluid add 1 gallon Water Saturated

to 1 gallon Sul A

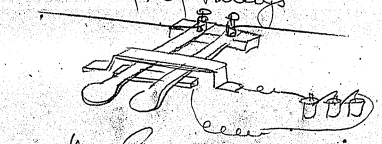
[20]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

Simplicity



Receiving Key Variety



Very Convenient

Key weak recg current sometimes the permanent Magnetism is equal to recd Current in that Case the relay opens when Key closed.

[21]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

24

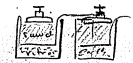
Reversed Current translator

Reffect open ckt regulator,

Serial RR signals get

discipline from Apang

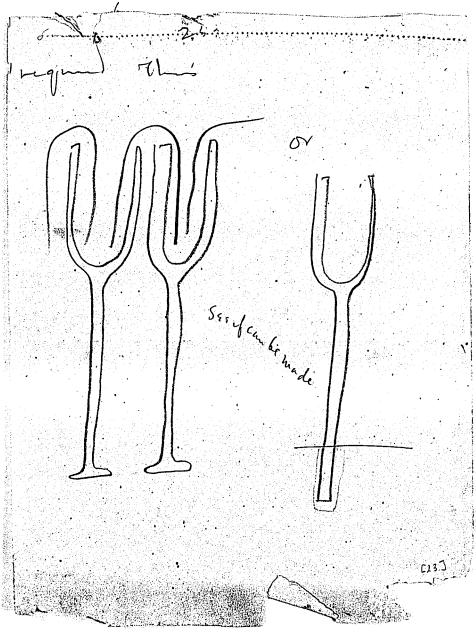
Test 6 alters



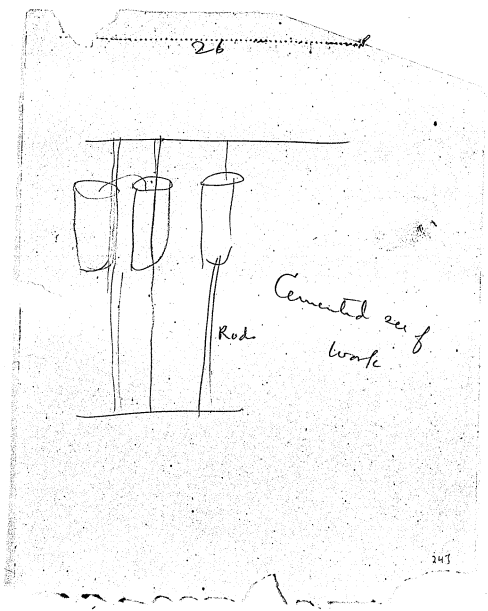
When Gotta modulation

(123)

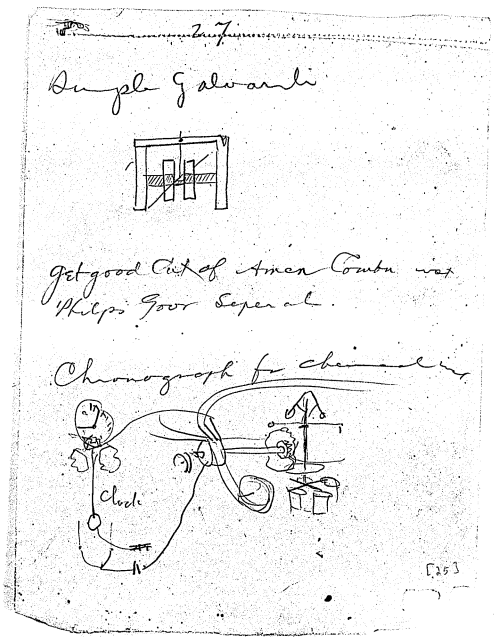
3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



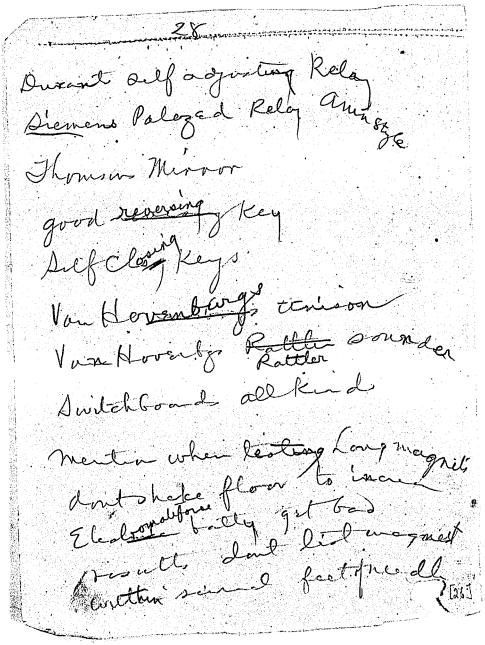
3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



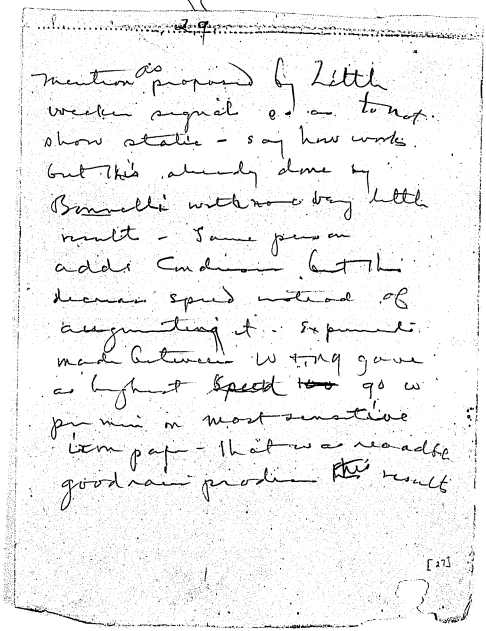
3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



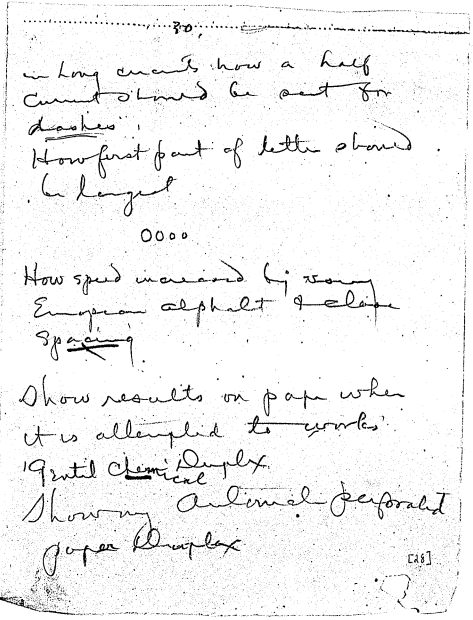
3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



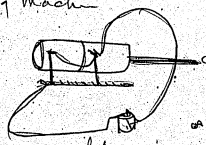
3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



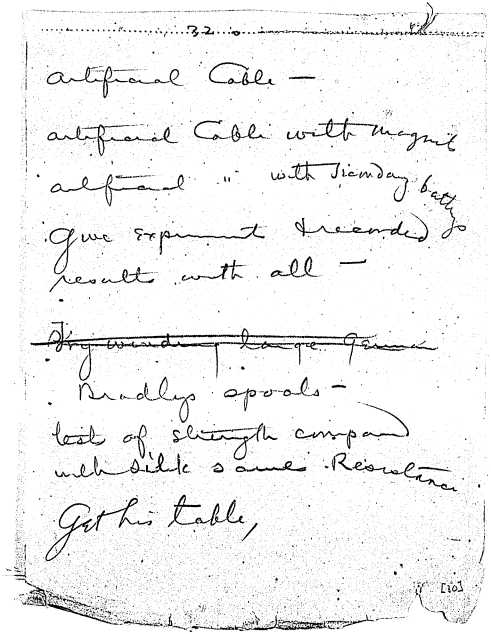
3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

My perforator Old, new -
Modification by Pettibone Mulliken
Roman perforator.
old pope feed.
3 Key perforator,
Combination to produce Morse
Character Etc Roman
Embossing.
45- lever printer
Chemical printing Machine
Milwaukee -

Copying Machine



3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



32

artificial Cable —

artificial Cable with magnet

artificial " with Siemday battery

Gwe experiment recorded to

result with all —

~~Big wonderful large Gauge~~

Bradleys spools —

test of strength compare

with Dilke's same. Resistance

Get his table,

[10]

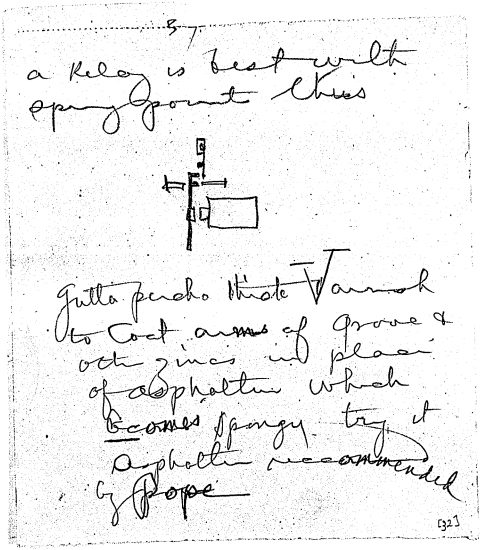
3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

Duplex Stations May have
Way station receive
by placing a very short
relay shunted =
& the Current from the
station sending is
double strength of
the other Current

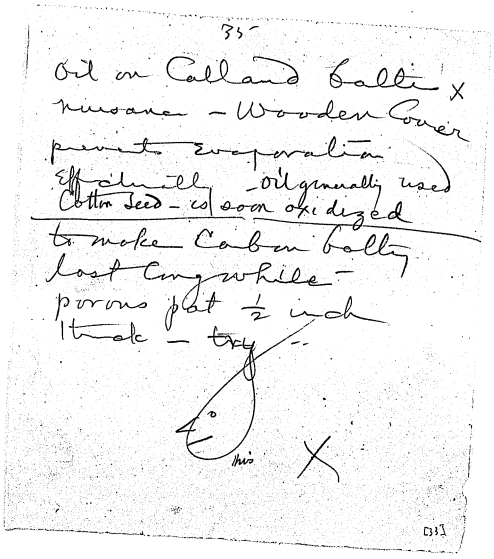
Duplex would be Best
when relays repeat
arrange Cut for that

[31]

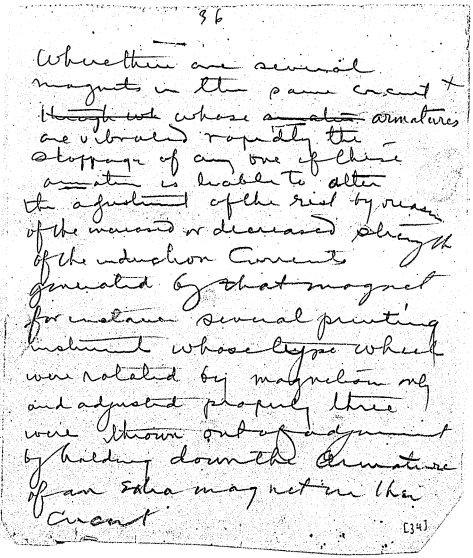
3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



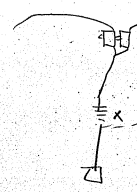
3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).


96

Where there are several magnets in the same circuit ~~through~~ whose armatures are vibrated rapidly the stoppage of any one of these armatures is liable to alter the adjustment of the rest by reason of the increased or decreased strength of the induction Currents generated by that magnet for instance several printing instrument whose keys when were rotated by magnetism and adjusted properly these were thrown out of adjustment by holding down the armature of one Sola magnet in the Circuit.

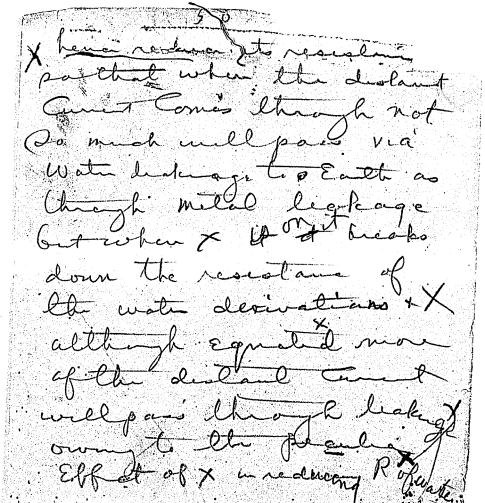
[34]

3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

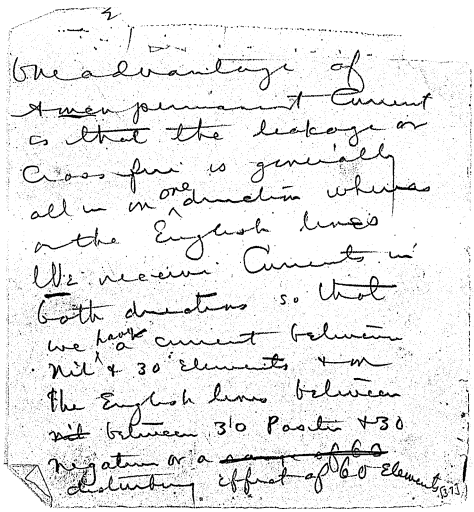


Resistance of leakage being water
& subject to polarization is decreased
by putting on battery X hence
when everything is equated for
the taking off of X will ~~also~~
~~make~~ take off a Edelmann
fuse off of the water leaks

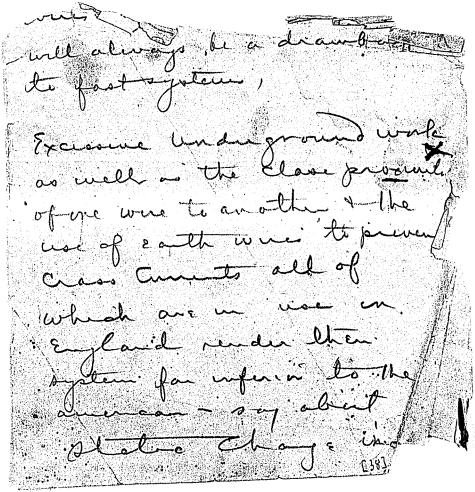
3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



3b Pages 1-11 of (3a) in Edison's hand. (38 small pages).



3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).



3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).

Notes 1 (1)

Neutralizing Escape Show Kramers method in a mm form

Show Smiths arrangement in good form Show 3 modifications of my Mk. Arrangement

Buy Bradleys gut-plates rubbed with cloth will electrify the needle and cause it to stick to metal circular may be discharged by lay. the flat of the hand on it. Show good cut also Separate cut Showing Coils & needle 000

Polarized Relays the bar being polarized by a small constant battery

Near Crocker Clockwork battery changer for Exclanche cut & description.

Holtzis Alarm

A mm District Regular with
" " Burglar Alarm

1 Doz goods Escapements: 2 or 3 good minions Sup Sterling Register

3c) Transcription of (3b) plus some additional material. (18 pages).

No. 2.

Notes

Register Repeats by lever & Embossed paper

Duplex learning Sending receive his own writing back

My two ways Duplex Act & description with my Batteries

Description & Cut my battery also result of Experiments on prevention of defficiency if thats not so then the reason Zinc kept down cause the action takes place right at Copper & Blue Vitriol used as fast as it tends to rise When in old way no action take place on rising fluid but way down at bottom.

Test that Spring pulling with & pulling against. Explain why

What induction be greater on lines whose poles dont make good Earth for in that low the distance from one wire to the other goes over the same material that it goes to ground. hence if the pole be very dry and makes poor Earth on closing conductive take place across the arms but quickly ceases owing to the polarization of the contact parts of the wire by the moisture of the wood. this would Explain the great induction on the Overland wires running through dry desert.

3c) Transcription of (3b) plus some additional material. (18 pages).

Notes

One of the reasons why receiving via ground wires is not uniformly successful is because of Return currents from other wires which when Exactly Equal make the Relay Open when Distant wave closes & when not Equal reduces the Effective working Strength of the distant current.

Secondly to the Interactions of the return leakage owing to the reverses of the feeding Batteries. The cause of bad working is duplex. balance the leakage is done by the plan now used but not in duplex.

I was told at Greenwich that Earth currents on Atlantic Cable sometimes potentiometer 60 Daniels cells Change from + to - sometimes in less than 1/2 minute

Spark due to a great number of magnets in Circuit may be nearly annihilated by putting 1/2 or 1/4 ohm coil each end etc etc.

placing thick pieces of paper between Armature & Screwing magnet up close so as to get core near armature and use powerful Spring of paper get very feeble signals

Pointed platinum points makes better Contact & Longer than flat.

3c) Transcription of (3b) plus some additional material. (18 pages).

Note 8/2/11

because in this case the Oxide has a clearance but with flat points it has not,

Compressed platina Hydralois or very hard drawn gave best spark test for Instt. persistent Silica Heat boarder points close etc. better than Relay etc gold leaf Experiments etc - Shows loss of part of Signal by shunting Lines

why Spring points should be used about Resumed of all keys - proved by the quick fall of current generating & break in undulations of magnet in bridge Shunting

---

When held free power ——

With Spring left

The pressure of contact points increase of Speed must have increased pressure - Copper better than platina — Oil good at first Oxidized by Spark dissolved in Excess the Oxide (Black) which drys quickly on ~~stopping~~ few minutes & hardens in places,

3c) Transcription of (3b) plus some additional material. (18 pages).

No 5

Notes

Show chemical records of a break wheel at same pressure at different speeds – See what increase must be given for increase of speed to get good record Need correction in involving shafts –

Vibrating points best

Compressed air sound in. Secondary batterys
Induction of condenser cable. Lay de- fors Secondary chemical action
Atlantic cable

Say chemical records splendid instrument for investigation by Comparison –

Sending battery shunting a relay

4 Wires

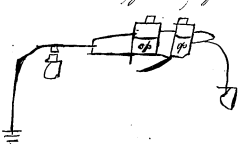
3c) Transcription of (3b) plus some additional material. (18 pages).

Notes No 6th

Describe effect shown course of Currents-
Automatic flame of putting number of way offices
on wire & get signal from main relay-.

Work up system of register respecting - so as to combine
number of Branch offices with mains offices message
recd Embossed & transmitted over main wire from
embossed strips - Say peculiar strong paper used &
peculiar high Embossing.

Say old G.S. Relays although only 3¼ long extended
speed waves. Authors short slotting Relays allows of
nearly double the Number waves be used. boo used
by Gold & Stock Effects of polarized. yet not.



See if in movements precautions of acting by Vibrating
P & reversed coils double in Electro magnet
shown -

Note

Resistance Coils of Kansas silver & platinum wire, spirally wire on glass hard rubber &c =

Mention where a wire may get grounded through local connections with battery on floor damp places. Office wire for local running in damp walls over your pipes &c =

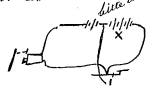
Law magnet used at Louisville having a total length 11 inches worked bad on dry days. Day bottoming of work dry

Secondary battery acting on land wire —

How working with a heavy battery through a weaker opposing battery. gives weaker current in closing P & R test Nov 27th

Against

Ayes confirmed — Noes



July 5th 1874

3c) Transcription of (3b) plus some additional material. (18 pages).

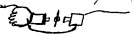
Notes No 8

Closing key relay close opening it relay opens & will again close. after a time depending on the amount of polarization of X battery - Scott thinks Daniels do this.

Compensating

Defeats of reverse currents when strong enough to fully clear the wire & give an Express —

My relay worked by displacing the polarized & working from the discharge of the magnet — also this



Why a polarized tongue should lay horizontal instead of perpendicular.

Hooks Button
Authors Button
Hicks Old
Hicks No 2
Hicks Latest
Bunnell
Haskins
Milliken

3c) Transcription of (3b) plus some additional material. (18 pages).

Nos 9

down & dashes

Marks can be sent on paper at the rate of
— miles per minute by using a station worked
& keeping it by battery (Morse) Register may be used
for perforating paper. ' '

Pivots to platina for contact comes nickel in most
instances it is as good as platina and very much
cheaper. It is used for contact Roller in perforated
paper transmissions and give good Contact at 3000
words per minute or 60000 waves.

The discharge from the magnet in a circuit does not
seem to interfere with the speed, show chemical records

The reason why the spark is so much greater on a local
current with a grove or carbon battery than with a Daniell
of the same strength, is owing to the greater internal resistance
of the latter - by short circuiting a main Telegraph battery
Composed of grove or carbon batteries we obtain a dazzling
Electric light - but if 20 ohms or even less be inserted
as a part of the short circuit wire the spark is
only just perceptable - Hence extra resistance is inherent in
the Daniells

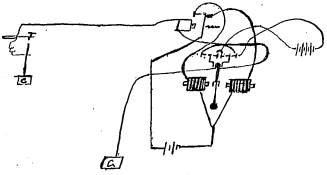
3c) Transcription of (3b) plus some additional material. (18 pages).

Table of Contents

Uses for local circuits in different apparatus
When a great number of contacts are made the call and
should be used —

Movements — Pope had it struck mixed one his R R Signal

Method of getting reversal on a line at one station
when from no battery at the distant station.



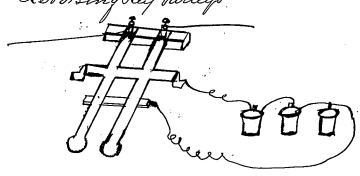
Pope page 19 =
To make Ordinary Red fluid —
1 Gal Sulphuric Acid - 3 gal water - in seperate vessels
dissolve 6 lbs Bichromate of Pota in 2 Gal boiling &
add to other Stirring thoroughly the preparation of potash

3c) Transcription of (3b) plus some additional material. (18 pages).

Sometimes made 1/5 Greater to make a more quantity using fluid add 1 Gallon Water Saturated Solution of Bichromate - to 1 Gallon Sulphuric Acid

Simple Key

Reversing Key Varley



Very Convenient

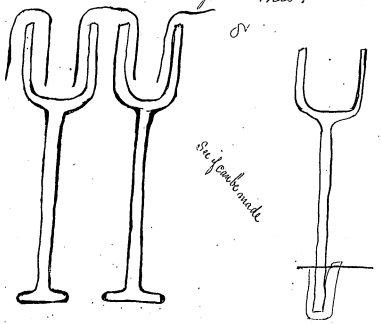
Very weak receiving current sometimes the permanent magnetism is Equal to the current in that Case that Relay opens When Key closed

(12)

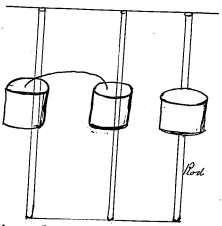
Reversed Currents translators & efforts open circuit repeater - Several W.P. signals get description from Spang.

Test Batters.

When better insolation - required this.



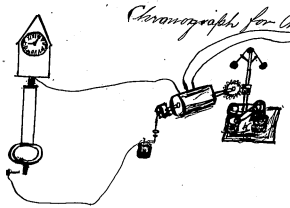
3c) Transcription of (3b) plus some additional material. (18 pages).



Simple Galvanometer

Get good cut of American Combination visit to Phillips Gerrior Separati.

Chronograph for Chemical Lect



3c) Transcription of (3b) plus some additional material. (18 pages).

Durants Self Acting Relays
Siemens Biassed relay American Style
Thomson Mirror
good receiving Key
Self closing Keys
Van Hoevenburgs unions
Van Hoevenburgs Battery Sounder
Switchboards all kinds,
Insertion when testing long magnets don't shake floor
to increase Electromotive force battery - Get bad results don't
test magnets within several feet of needle.-

Machine as proposed by Little - weaker Signals so as
to not Show Static - Say how works - but this already
done by Bonnelli with very little result - Same person
Adds condensor but this decreases speed instead of
Augmenting it - Experiments made between Washington
and New York - give as highest speed 90 words per minute
on most sensitive iron paper that was readable -
good Varnish produces this Result - Use long circuits
how a half current should be sent for dashes.
How first part of letter should be longest.

OOOO

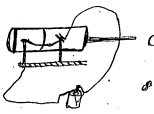
3c) Transcription of (3b) plus some additional material. (18 pages).

15

How Speed increased by using European alphabet & close spacing.

Show results on paper when it is attempted to work Gentil chemical Duplex = Showing Automatic perforated paper duplex.

My perforated Old (new)
Modification by Peekskill man
Roman perforator
Old paper feeder
3 Key perforator
Combinations to produce morse character Eli Roman
Embossing
45 lever printer
Chemical printing machine
Milwaukee
Copying Machine



Thick ink Iron filings

3c) Transcription of (3b) plus some additional material. (18 pages).

16

Artificial Cable —
Artificial Cable with magnet
Artificial Cable with Secondary batterys.
give Experiments & recorded results with all

Bradleys Spools —
Tests of Strength comparison with silk Same resistance —.
Get his table

Duplex Steams may have way Stations receive by using a very Short relay shunted & the current from the Station Sending is double Strength of the other current.

Wheeler would be best when relays repeat
Arrange cut for that.

A. Relay is best with Spring points thus.

3c) Transcription of (3b) plus some additional material. (18 pages).

Guttapercha thick Varnish to coat arms of grove & other zones in place of asphaltum which becomes Spongy try it Asphaltum recommended by Pope.

Oil on Callaud bulle nuisance – Wooden Cover prevents Evaporation + Effectually – Oil generally used Cotton Seed – is soon Oxidized to make Carbon battery last long while porous pot 1/2 inch thick –
Dry.

Where there are Several magnets in the same circuit whose armatures are vibrated rapidly the stoppage of any one of their Armatures is liable to alter adjustment of the rest by reversing of the increased or decreased Strength of the induction Currents – generated by that magnet, for instance Several printing instruments whose type wheels were rotated by magnetism only and adjusted properly Those were thrown out of adjustment by holding down the Armature of an Extra magnet in their circuit

3c) Transcription of (3b) plus some additional material. (18 pages).

Resistance of leakage being water & subject to polarization is decreased by putting on battery X hence when Everything is Equated for the taking off of X will take off a Electromotor force of the water leakage.

Hence reducing the Effect

So that when the distant current Comes through not so much will pass via water leakage to Earth as through metal leakage, but When X is on. it breaks down the resistance of water leakage x although Equated more of the distant Current will pass through leakage owing to the Effect of X in reducing R of water.

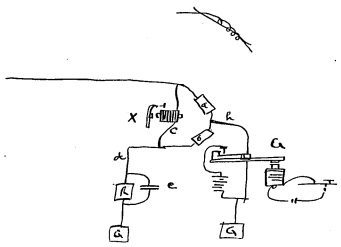
One Advantage of American permanent current is that the leakage or crossfire is generally all in one direction where as in English lines. We receive Currents in both directions so that we have a Current between Nil & 30 Elements & on the English lines between 30 positive & 30 negative or a distinctly Effect of 60 Elements where as present insulated will always be a drawback to fast Systems

Excessive underground work as well as too close proximity of one wire to another & the use of Earth wires to prevent Cross Currents all of which are in use in England render their System far inferior to the American. Very about Statics

Change increased

3c) Transcription of (3b) plus some additional material. (18 pages).

If the receiving instrument be a Mirror galvanometer the induction Currents generated are very weak and will scarcely disturb its working but if the ordinary Morse relay is used the induced Currents will produce a multiplication of the signals as the shorter the Cores of the receiving magnet are the less the discharge. figure 11 shows this method,



3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).

A B are adjustable resistance coils, which independant of the other Connection form a shunt around the receiving instrument. d is the artificial line, R the rheostat for make the resistance Equal to the line and c the Condenser to produce a static Charge upon the artificial line Equal to balance the static Charge upon the regular line, & h is the battery wire placed between at the central point of resistance of the shunt. G is the usual device for connecting & disconnecting the battery. If the rheostat R is adjusted so that it shall have the same resistance as the line wire, and the Condenser c has the same

3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).

Electrostatic Capacity as the Case. Then there are two wires one on one side of the resistance and one on the other side of the resistance both having the same resistance & Electrostatic Capacity. If the resistance a b are equal or resistance and the battery is Connected to the Bridge by the upper movement of the sounder lever. it follows that the Current will divide Equally upon the regular & auxiliary wire. and those units pass down the bridge wire c Containing the receiving instrument as the resistance on both sides are an equal and there is no Cause for a deflection of galvanometer. If no Condenser was Connected to the auxiliary wire that portion of the Current due

3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).

To the static charge of the line would pass through the instrument, O

The resistance of the artificial line can be reduced to less than the resistance of the line and the difference compensated for by increasing the resistance of the Rheostat B, but the Electro the decrease of resistance between the armature of the Condenser & the other of course decreases the electrostatic Capacity of the artificial line &. When signals are received from the distant station more one half of the current passes through the coil a to the ground via b the other portion through the relay. thence through b to the ground and a small portion through d to the ground

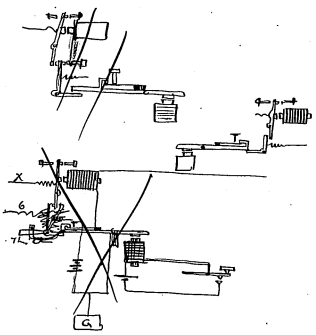
3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).

When the signal ceases the induced current from the magnet circulates within the circuit formed by a. b. c thus preventing the instantaneous change and discharge of the relay and annulling the signals in the exact proportion as the length of the coil of the magnet and number of the Convolutions are increased and the resistance of the derived circuit. This effect is partially compensated for by the slight static reluctance changes which are generated by the small quantity of current which passes to the ground through d.

Mr Stearns is the inventor of another very ingenious modification which

3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).

is shown in figure ——.



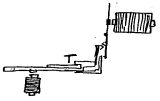
The ~~back~~ effect of the outgoing current in this method is compensated for by mechanical means a is a lever b, a ~~spiral~~ a retractile spring having a tension equal to the effect ~~extra~~ magnetism ~~due~~ in th

3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).

Relay due to the outgoing Battery
This Lever comes in Contact +
rests on the Extension of the relay
Lever When the Sounder Lever is
raised and the Contact
~~Contact~~ ~~the battery points~~
seperate and the Battery is
thrown on the line
The advantages of this method
is that if the Equation be not
perfect no extra signals
will be thrown in as in
the Double Coil duplex
but the effect will be to
~~Although the signal~~
of ~~y~~ to be a question frequently
Mr Stearns discribes no
method of Counteracting
the Static Charge.
This charge may be Counteracted
Mechanically as shown

3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).

on fig.

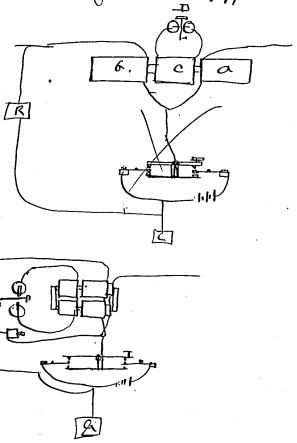


The following ~~systems~~ methods were devised by the author and are on illustrations of the enormous number of combinations which it is possible to make with telegraphic apparatus. A portion of them have serious defects, while others are ~~as nearly perfect as it is possible at the present time~~ while others will perhaps be found as are more perfect than the method now in use,

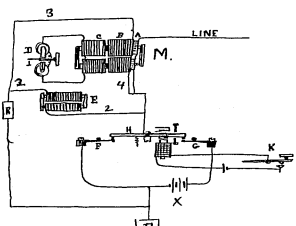
The first method which I shall now describe is worked Entirely by induction, which requires less perfection of balance

3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).

and has a great working
[illegible] argin besides allowing the use
of apparatus which is nearly
[illegible] of adjusting. This method
is shown in figure ###



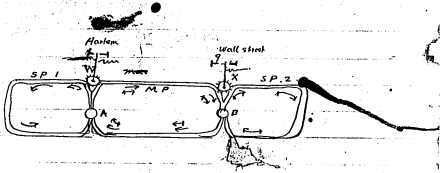
3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).



M is a long Electromagnet upon which are wound the coils A.B. in opposite directions to one another, The Coil A is in the main line circuit and the Coil B in the artificial line R is the resistance Coil adjusted so that its resistance including the Coil B Equals the resistance of the Line, C is an Extra Coil not in Connection with Either Circuit. The two free ends of

3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).

2 (1878)



~~M P is the main water pipe~~; We will Suppose that this water pipe Current ~~Extended~~ Extended from Wall St to Harlem, and that A and B are ~~Steam~~ Engines & Reservoirs by which a Current of water ~~and~~ any desired amount might be made to circulate in the ~~direction~~ direction as indicated by the arrows.

W and X are two water wheels provided with levers, which ~~open~~ ~~close~~ strike between fixed points

4

4) "We will suppose that . . ." (7 pages; incomplete; Edison's hand).

3 Duplex

~~A~~ spiral springs are secured to these levers to keep them against the proper point when no water passes,

The object of the secondary water pipe circuits SP 1. SP 2 will ~~be explained presently~~ explained when we proceed a little further.

Now suppose that a stream of water was thrown into the main pipes by A, it would but half fill the water pipes and traverse it on the direction shown by the arrows. The action of the passing stream of water would be to slightly move both the wheels and bring their levers from one fixed point to the other, ~~hence by alternate~~

When the water is stopped the levers are drawn back by the

4) "We will suppose that . . ." (7 pages; incomplete; Edison's hand).

~~Each~~ springs, so for the message
Signal has been received at
both the home and distant Station
It remains now to trouble how
the wheel ~~at the~~ X is left to
respond to A, and the wheel W
prevented from doing so.
You will notice by a ~~line~~ to
the diagram that the water
Circuit S.P.I. is so arranged upon
the opposite side of the wheel
that the stream of water which
is injected into S.P.I. from A. tends
to turn the wheel in a direction
just the opposite to that injected
into M.P. hence if the amount
and speed of the water in both
the main & secondary pipes are equal
it is obvious that the wheel W
will not move; and as long
as these ~~eq~~ balances are obtained
any kind amount of water ~~or the~~

4) "We will suppose that . . ." (7 pages; incomplete; Edison's hand).

Travelling at any speed
~~speed which it circulates in the~~
~~line Circuit~~ may be sent from A
into both Circuits without moving
the wheel W. ~~B~~ The distant
station ~~the~~ water ~~m~~ ~~es~~ the wheel
as none of it can circulate in the
Secondary Circuit ~~SP~~ of that
Station,

Or we will now suppose that a
~~Stream~~ of water from A is circulating
~~On~~ SP1 and the main Circuit.
Cause of the
If the wheel X is moved to the
left hand point, W remaining
unaffected ~~as above as before~~ shewn before.
If now the apparatus at B is
so arranged that the water may
be injected into the the main pipe
Secondary Circuit in the same
direction as that injected by A,
injected by main current MP
the effect of the ~~extra amount~~ of water
on the wheel X is exactly balanced
by that which circulates in the circuit
SP.2. & does not prevent the wheel X from turning by the water sent
~~but this excess~~ of from W

4) "We will suppose that . . ." (7 pages; incomplete; Edison's hand).

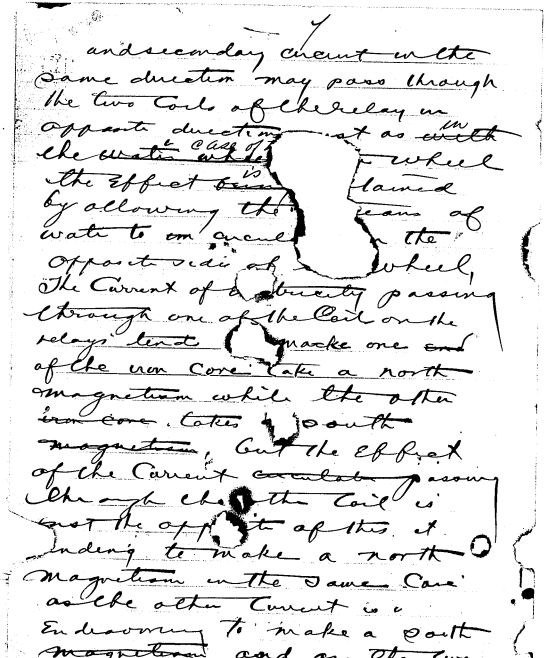
the water ~~injected at~~ [illegible] MP ~~[illegible]~~ The Galvanic ~~[illegible]~~ ~~[illegible]~~ ~~at~~ ~~[illegible]~~ between MP & SP.I. and the Excess from P flows the lever over to the left handed [illegible].

It will be seen that ~~[illegible]~~ it is not necessary that the ~~[illegible]~~ should ~~be~~ flow in opposite ~~[illegible]~~ directions to obtain these ~~[illegible]~~ ~~messages~~; al,

~~It is possible to Harmonic~~ ~~The waves from B could be made~~,

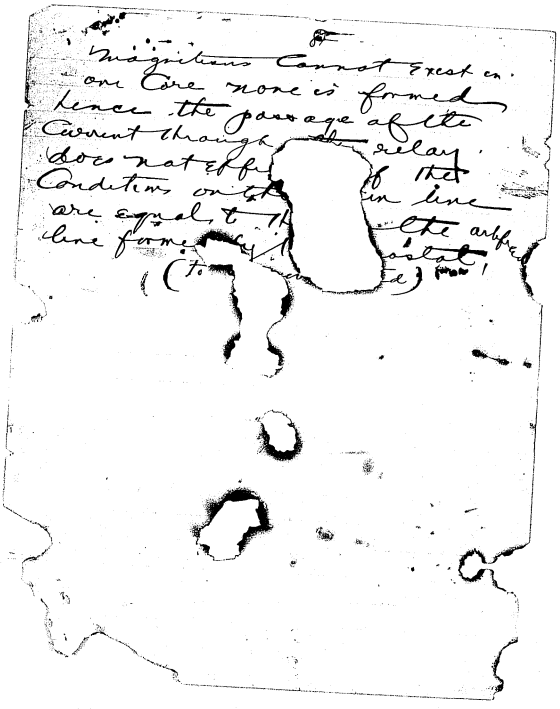
In the electric Duplex the secondary Circuits are replaced by the Rheostat, in which are coils of fine wire, so arranged that ~~any~~ ~~[illegible]~~ ~~such~~ an amount of fine wire may be inserted sufficient to ~~work~~ retard or set up a resistance to the passage of the Current equal to that offered by the line, The water wheel is replaced by a relay having double coils of wire so that the Current passing over both the line

4) "We will suppose that . . ." (7 pages; incomplete; Edison's hand).



and secondary current in the same direction may pass through the two Coils of the relay in opposite direction at as with the water wheel the Effect is claimed by allowing the beam of water to impinge on the Opposite side of the wheel, The Current of electricity passing through one of the Coil on the relays tends to make one end of the iron Core take a north magnetism while the other iron Core takes a South magnetism, But the Effect of the Current through the other Coil is just the opposite of this it tending to make a north Magnetism in the same Core as the other Current is endeavoring to make a South magnetism and as the two

4) "We will suppose that . . ." (7 pages; incomplete; Edison's hand).



4) "We will suppose that . . ." (7 pages; incomplete; Edison's hand).

2. Duplex

the effects of the transmitting battery upon the receiving relay at the same terminal.

The second feature, is to preserve the continuity of the circuit and equality of resistances in the act of signalling*

Mr Stearns method is shown in figure.

A is the duplex relay for receiving the signals from the distant end. The iron cores of this relay are wound with two distinct wires insulated from each other,† and so connected that the current from the battery G passes through each wire in opposite directions, One wire or bobbin is placed in the main line circuit, while the other is placed in the artificial line circuit.

† Two bobbins are shown in the engraving to convey a clearer idea,

* Invented by Prof. Gray of Boston in 9 adopted by Stearns,

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

3. Duplex

When the rheostat in the artificial line is adjusted to offer a resistance to the passage of the current, equal to that offered by the main line, then the passage of the current from the main battery G over both lines will produce no effect on the relay A. as the tendency of the current circulating within the main line bobbin is to produce say a north and south polarity in the soft iron core, while the current in the bobbin connected to the artificial line tends to reverse this action. Hence the cores will not become magnetized.

Should the resistance of one circuit be less than that of the other, more current will pass through one bobbin than the other and the cores will become magnetic to that extent, ~~and~~ attracting the armature

The main battery is connected and disconnected from the two circuits by the lever H operated by a magnet placed in a local circuit ~~with~~. This circuit is opened an ~~closed~~

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

4 Duplex

by the Transmitting key K.

The Lever H is connected to earth. A spring a to which is connected both the main and artificial circuits is secured to the Lever H by a block of Vulcanite,

When the Lever is unattracted by the local magnet this spring is in contact with the bent end of H, completing the circuits to earth. If the is attracted by the local magnet. the spring a is is thrown away from the Lever by coming in contact with the point c. The continuity of the circuits is still complete, but the battery a is placed on both circuits,

Mr Stearns inserts a small resistance in the earth wire at R to lessen the spark at the moment when the spring a comes in contact with the point c and before it is seperated from the bent lever,

It will be observed that neither the continuity of the circuit is broken or the resistances materially changed in the act of signalling.

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

and as the current from the battery G when permanently connected to line produces no effect upon the relay A. it follows that if the current on the main line be increased over that circulating on the artificial line by connecting the battery at the distant station the cores of the relay will be magnetized and attract its armature, The same action takes place when the battery G is disconnected. for then there is no current on the artificial line while the current from the distant station is free to magnetize the cores of the relay

So far this arrangement answers for ~~short~~ aerial circuits of 100 miles or less, but on longer circuits, the ~~phenomena~~ of static induction tends to destroy the balance which must be maintained between the two currents passing through the coils of the relay ~~A~~. To preserve the balance Mr Stearns attaches the condenser C

5a) "The effects of the transmitting battery . . ." (10 pages; incomplete; Edison's hand).

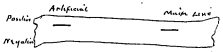
to the artificial line so as to obtain the as much static induction on the artificial as is necessary to balance with the coils of the duplex relay the static induction of the main line, this method of attaching the condenser is somewhat defective as it only partialy compensats for the static induction of the line nevertheless it is effective except on very long circuits of considerable Electrostatic Capacity

The action of the static induction on this particular case is well illustrated by the chemical strips.

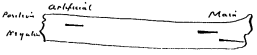
When the condenser C is disconnected from the artificial line & the battery G be put to in connection with the two circuits, the line wire being free from static induction a dash will record itself upon the chemical strip, as in fig.

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

7. Duplex



If the main line has considerable electrostatic capacity, the record will be as shown in fig



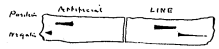
~~Static induction~~ the inductive current on closing is added to that of the battery this of course destroys the balance and the relay lever upon which the first part of the wave passing within the circuit of the artificial line is not augumented, upon disconnecting the battery, a static discharge is obtain which circulates in a direction opposite to the battery current, This wave which at first strong gradually ceases as shown on the slip, The longer the circuit the greater the length of line will the discharge take to fall to nothing, If the condenser is now added to the artificial line as shown in figure. The slip will

That produces another movement of the relay lever & , giving a false signal

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

8 Duplex

present a different appearance, as in figure



Mr Stearns manner of connecting the Condenser, does not produce the same effect as is produced upon the line, the difference is scarcely perceptible on short lines, and the compensation is practically sufficient but as explained before when the line is very long this method of Compensation is defective,

The line itself is a condenser or accumulator of static electricity which is distributed on along its Entire length, and the charge upon Each successive mile from the battery is less and less, ~~but the~~ and a certain time is consumed in charging it. But the condenser being in direct contact with the Battery (with the Except of the relay resistance) is almost instantly Charged. On disconnecting

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

9 Duplex

The battery. The condenser is almost instantly discharged owing to the low resistance connecting its two armatures, but it is not so with the line. The static charge must pass through a considerable resistance which of itself is an accumulator hence the current will flow on the line some time after the condenser has completely discharged itself, and this excess of current circulating in one line although not powerful enough in some cases to give a distinct movement to the relay lever is sufficient to mutilate the signals from the distant station as shown in fig

~~Or when received by sound~~ will certain letter such as m g etc will be turned into L and N.

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

10 Duplex.

To more closely produce or imitate the conditions of the main line upon the artificial one, the condenser should be divided up into several parts and inserted between the several resistances composing the artificial line as shown in figure — This will distribute the static charge over the whole of the line and the length of time which it will take the charge to fall from maximum to zero will be equal to that of the line ~~dis~~, and a perfect balance of forces become possible,

It does not matter what condition obtains on the regular line so as it is imitated upon the artificial line as the balance will be maintained for instance if an ordinary relay be inserted in the line wire. the it will generate an ~~discharge~~ inductive current which destroys the balance

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

11 Duplex.

But if a relay of the same character be inserted in the artificial lines the balances will be restored, although this does not compensate for the action which the discharge inductive current has on the receiving or relay independent of the balance on the distant relay produces; (be) (is)
mutilation of signals as shown in fig.

but this effect is not so bad as the destruction of the balances.

There exists another defect in this form of Duplex which is the self induction of the relays themselves no self induction is produced upon the home relay by the outgoing current if it be well balanced. But with the current from the distant station it is different. To this current the Double coil

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

acts as an induction coil ~~so to speak~~.
The primary coil being in connection
with the line while the secondary
Coil is the bobbin connected to the
artificial line, when the distant
battery is connected. The tendency
of the line wire bobbin is to induce
a wave into the artificial line
~~Coil of an opposite character~~ which
is augumented by the action of the
condenser. These waves secondary
Currents reacting upon the relay
tend to emulilate the signals. Several
hundred of Mr Stearns Duplex are in use in this country
The author dispenses with the
Condenser an produces the same
results with an electromagnet,
fig " shows this arrangement.

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

13 Duplex.

M is an electromagnet with twice or thrice the resistance of one of the bobbins upon the relay. It is provided with an adjusting device by means of which the magnet may be made to approach or recede from a fixed armature C. If the magnet be adjusted ~~very near to the fixed armature its self induction will be increased~~ so that the faces of its cores will touch the fixed armature. The self induction of the magnet will be at its maximum and it will be decreased as the magnet recedes from it. ~~The equation of the static charge.~~ Supposing the current of the battery G to be placed permanently on the line ~~the operation will be as follows upon disconnecting it~~. The line and magnet becomes charged now upon disconnecting the battery the static charge acting upon the main line bobbin tends to magnetize the cores of the relay as ~~has already~~ in the manner

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

already described. But at the same time the induction current from the magnet M circulating within the closed circuit formed by the wires 3 4 and 5 and the bobbin tend to produce an opposite Effect and the relay remains unaffected, If the main line gives a strong discharge then a discharge Equal in strength may be generated in the Electro magnet M by adjusting it nearer the fixed armature,

Upon closing the induction current is added to that of the main battery current in that portion of the circuit formed by the bobbin & wire 5.

~~It~~ It is obvious that this device forms a much more convenient economical & effective arrangement for obtaining Equation than the condenser

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

15 Duplex

When used in connection with submarine Cable or land lines of great static Capacity the magnet A should be several times as Long as the receiving magnet, otherwise the inductive Current will cease before that of the Line,

By this arrangement a Local Circuit operated by a second Battery may be used which is not possible with the Condenser, as in figure — —

5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).

Photocopy. Original is in Scrapbook, Cat. 297, Notebook Series.

/ Duplex

The Duplex principle was invented by Dr Gentl, ~~The first practical Duplex was invented by Glaser & Farmer of Boston in But the modern Duplex and the one which~~ But the first practical Duplex was invented by ~~E B~~ Mr Stearns ~~of Boston~~.

As Duplex instrumentation is one of considerable importance at the present time and a branch which illustrates the vast number of combinations which may be made to produce the same result and the explanations it gives to several phenomena hitherto not well understood will be my excuse for the great ~~length~~ number of pages devoted to this subject

103 (2)

5b) "The Duplex principle . . ." Another version of (5a). (9 pages; incomplete; Edison's hand).

2 Duplex

The author has made an immense number of experiments in this branch of telegraphy and feels that he is competent to ~~of which the following articles are made~~ are abstracted from, and most of the devices described in the following pages are the result of Experiment,

In that class of Duplex (or which signals are sent in the Opposite direction at the same time) The main feature is to neutralize all the effects which are produced by the action of the outgoing current upon the receiving instrument at the same station, The second feature is to preserve the Continuity and Equality of resistances in the act of signalling*

* first invented by Jenkin in — & adopted by others,

5b) "The Duplex principle . . ." Another version of (5a). (9 pages; incomplete; Edison's hand).

3 Duplex

Mr Edarn's method is shown in figure

A is the Duplex relay for receiving the signals from the distant station, †yy is wound with two distinct wires arranged in such a manner that the current from the main Battery G ~~shall~~ passe through Each wire in opposite directions ~~to~~. One helix is in the circuit of the main line. The other is in the circuit of the artificial line.

When the Rheostat in the artificial line is adjusted to offer a resistance to the passage of the Current equal to that offered by the main line. The passage of the current from the Battery G over both lines will produce no effect on the relay A, as the tendency of the main line bobbin is to produce a north and south pole in the Cores of the relay while the effect of the bobbin in the artificial is just the opposite & neutralizes this tendency and no magnetism is produced.

† I show two helix of wire so as to illustrate the principle more clearly but the wires are usually wound side by side

5b) "The Duplex principle . . ." Another version of (5a). (9 pages; incomplete; Edison's hand).

4 Duplex

should the resistance of one circuit be less than the other. Then the balance more Current will pass in the Circuit of less resistance and the excess will manifest itself by on the rela by attracting the armature of the relay with a force proportionate to the excess of Current passing in the circuit of lowest resistance,

H is a lever operated by a local magnet in a Local circuit broken by the transmitting Key K.

This lever H is connected to Earth, a is a spring insulated from secured to a piece of Vulcanite on the lever H. and This spring is connected to the jointed Circuit, Main + artificial line,

When the lever H is unattracted by the Local magnet the spring a is in Contact with the Earth through the lever H at end of the

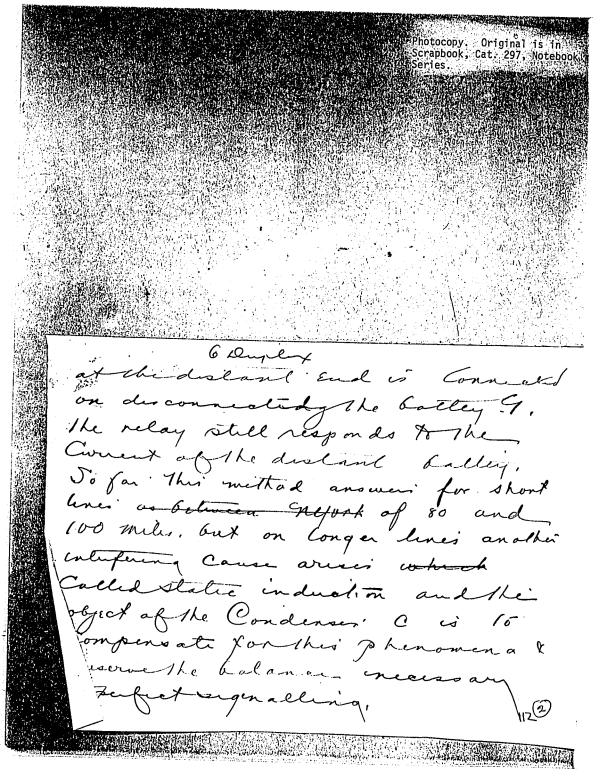
~~Contact point in Connection with~~ ~~Hammer Rolling G. but when the~~ The Current from the distant station will have a clear route to the Earth. When the lever H is attr

5b) "The Duplex principle . . ." Another version of (5a). (9 pages; incomplete; Edison's hand).

4th Principle

by the local magnet is alliacted, the spring is disconnected from the Earth lever and Earth is connected to the point C and battery to Earth, R1 and R1 are small resistance coils inserted to reduce prevent the spark at the moment when the separation of the spring a from the lever takes place as at this moment the battery is "shortcircuited" It will be observed that in signaling that the battery 9 is connected & disconnected without breaking the Circuit or materially altering the resistances, and as the action Effects of the battery is not upon receiving relay it follows that if the Strength of the current on the main line is increased by adding the battery at the distant Station, that the balance will be destroyed and the relay lever will be attracted Each time the battery

5b) "The Duplex principle . . ." Another version of (5a). (9 pages; incomplete; Edison's hand).



6 Duplex

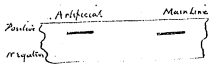
at the distant end is connected on disconnecting the battery G, the relay still responds to the Current of the distant battery. So far this method answers for short lines as between ~~Orange~~ of 80 and 100 miles, but on longer lines another interfering cause arises which Called Static induction and the object of the Condenser C is to compensate for this phenomena & secure the balance necessary perfect signalling.

12 (2)

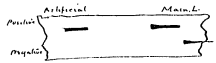
5b) "The Duplex principle . . ." Another version of (5a). (9 pages; incomplete; Edison's hand).

Photocopy. Original is in Scrapbook, Cat. 297, Notebook Series.

7 Duplex.



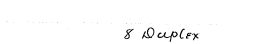
If the main line has considerable electrostatic capacity the record will be as shown in fig on closing and opening



115①

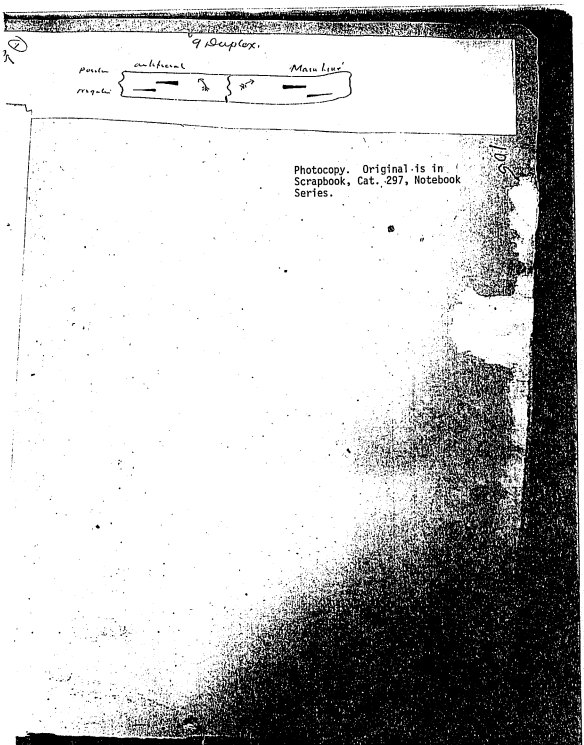
5b) "The Duplex principle . . ." Another version of (5a). (9 pages; incomplete; Edison's hand).

present a different appearance



It will be noticed ~~by referring to the~~ the records both of the main and lines present nearly the same app The charge & discharge from the condenser same strength as that of the lin is of very short duration as ~~well~~ ~~discharge~~, The reason of this is Charge and discharge of the l Effected through a considerab while that of the Condenser is ~~so con of can discharge~~ This result is through a very slight resistance If the condenser be divided up int parts and distributed also bet resistance coils as in fig th and discharge may be made Equal to that of the main fig will show the record whe balance is perfect.

5b) "The Duplex principle . . ." Another version of (5a). (9 pages; incomplete; Edison's hand).

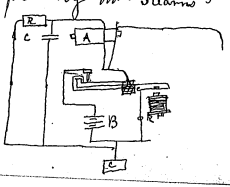


Photocopy. Original is in Scrapbook, Cat. 297, Notebook Series.

5b) "The Duplex principle . . ." Another version of (5a). (9 pages; incomplete; Edison's hand).

No 1

In a Duplex apparatus by which
Signals can be Transmitted
in opposite directions the main feature is to Neutralize
the effects produced by the outgoing current upon the
receiving instrament the second feature is to Keep the main
line while Signalling nearly at a constant resistance this result
was first obtained by Mr Stearns on the Ordinary Telegraph
circuits the Mode of obtaining a constant resistance
was devised by Messrs Farmer Many years ago and
Subsequently adopted by Mr Stearns
Stearns Method.



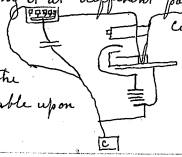
6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

No 2

A is the Duplex relay for receiving the Signals from the distant station it has double coils wound around its cores in opposite directions to each other so that the current from the battery B passes through one helice in one direction & through the other helice in an opposite direction one helice is in the line wire the other helice is in an artificial line of the same resistance made so by a set of resistance coils X if the line on which this relay is placed is but a few miles in length the artificial line composed of resistance coil will Exactly imitate and produce the same effects as the line wire when the resistance of both are Equal the battery B when thrown in circuit by the attracke of the Sounder lever transmits a current of the same Strength upon the regular and also upon the artificial line these currents passing through the Two helice of the relay tend each to produce a magnetism in the cores opposite to each other consequently no effect is produced upon the relay any excess of current due to the battery At the the distance Station passes through one helix only hence the relay responds to any excess of current either on on the regular or artificial line now if the line upon wich one helix of the the relay is placed is long the Extra effect produced inwich is not produced upon the artificial line although both may have them

6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

Some resistance This extra effect is called Static induction ~~and any equal amount which~~ and this Static induction must be produced upon the artificial line before an exact balance can take place to produce the same static charge upon the artificial as produced upon the line Mr Stearns inserts a condenser in the manner shown in figure one when the current from the battery B is thrown upon the regular and artificial line the line and condenser both produce a static charge in the same direction as the battery current balancing themselves in the double helices of the relay while the battery remain on the line which is in fact a condenser + Condenser become statically charged so that when H is is disconnected a static charged flows out of the regular and artificial line in the opposite direction to the battery current but as before owing to the reverse direction in wich the wire on the relay is wound the neutralize Each others effect from the Condenser may be varied as shown on figure 2 we by connecting it at different points of potential



This Method of connecting The condenser does not produce the same effects as that produced upon the line the difference is scarcely noticeable upon short lines

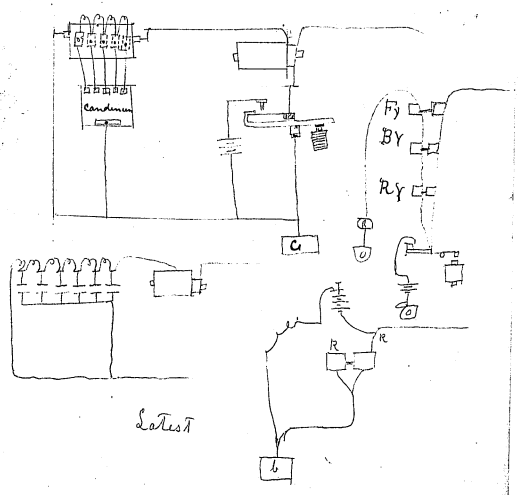
and the imitation is practically sufficcent but when when the line is very long and its static copacity very greeat This method of connecting the condensers doe not geve a perfect balance the line itself being a condenser or accumalatan of static Electricity distributed along the entire length it follows that ech successive mile from the battery receve less charge than the one before it the condensers is of the artifical line is immediately charged being in direct contact with the two poles of the battery when the battery is disconnected the condenser is quickly discharged but not so with the line The static charge accumulated at a distance from the battery must pass through a resistance which of itself is an accumulator of static Electricity this charge will follow out of the line Some Time after the Condenser on the artificial side has discharged itself which it does through no resistance this will of course throw the two circuits out of balance and interfere with the signal from the distant station the Effect being to strengthen and weaken these signals as for instance the letter H.... on closing and opening would be recevded ____.

more closely imitating or to produce the conditions of the mane line upon the artificial line The rheostat should be composed of a large number of small resistance Coils. between wich a few leaves of the Condensers is inserted

6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

No. 5

This will distribute the static accumulation throughout the whole length of the artificial line and the time of charge and discharge can be made the same figure 3 shows this method



6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

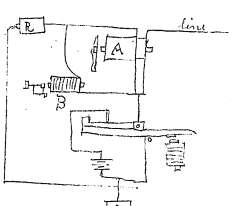
No 6

it is obvious that if the phenomena upon line any Telegraph circuit is exactly imitated and produced upon the artificial circuit that we will produce a perfect Duplex Telegraph as regards this one particular - it is known when the two circuits have been balanced that if an ordinary relay is inserted in the regular line the balance will be partially destroyed owing to the induction discharge from that relay but if another relay of the same Kind and of the same restance is inserted in the artificial line this effect is equated for but this relay in the regular line will weaken the first part part of a dash recived upon the relay from the distant station and prolong it after the battery has been disconnected at that end, but this effect is not so noticeable as that produced by distroying the balance there exists another defect in this form of Duplet which is the cause of considerable trouble which is the Self induction of the relay itself there is of course no self induction due to the outgoing battery but with the incoming current of the distant battery the case is different the helix in the artificial circuit act as a Secondary coil and the helices connected to the line is operated by the distant battery coil forms the primary - The accumulations Connected to the artificial line

6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

No 7

to augument the Strength of the inductive waves induced into the Secendary helice by the primary were Their no accumilation conected to the artefecal ciorcuit the Strength of the wave would be little but these Serve to increase its Strength $\frac{1}{2}$ which reacting upon the relay makes the received Signals very irregular the amount of induction may be determined by inserting a dilicate polarized relay in the artificial line when the batery B is not being operated the author dispenses with a condensers to obtain an artificeal line and produces the same effect by the inductive action of an electon magnet fig 4 Shows this arrangement



B is an electro magnet twice or thrice the resistance of one of the helices upon the relay it is also longer than the coils of the relay it is provided with an armature which

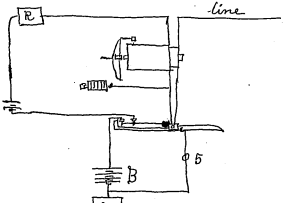
6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

the cores or adjusted some distance from them the purpose of which is to increase or decrease the length of its induction discharge the Close the armature the cores of the Electromagnet the greater will be the length on discharging Time. when the battery B is connected momentarily no induction action takes place in the relay the electro magnet B is charged and the regular line also at the moment of disconnecting the battery the line discharges its static Electricity through the inner helice of the relay but at the same time the magnet B sends an inductive discharge equal in Strength and length to the static charge from the line through the second helice thus preserving the balance the circuit in wich the induction discharge from the magnet has only the resistance of itself and one of the helices of the relay the induction circuit is shown by the dotted lines in this case the induction from the line helice of the artificial line has less Effect than when the Condenser is used the charging discharging Time of the magnet B can be almost indefinitely increased by increasing the length of the magnet

by this arrangement a local circuit operated by a small battery may be employed which is not possible with the condenser System thus in fig 5

6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

No 9



Mr Stearns inserts a slight resistance in the wire 5a for the purpose of preventing the entire short circuiting of the battery and also to lessen the spark at the contact points if this resistance be too small and several duplex circuits are worked from the one battery as is usual in the American closed circuit system signals will be quite irregular on all and especially upon the longer circuits as either one or the other of the contact points of the several duplex are constantly short circuiting the battery this rapidly exhausts it down increases its internal resistance to a point where with the two circuits of one duplex and several duplex working from the same battery with leakage and intermittent short circuiting reduced at the external resistance lower than that of the battery when this takes place the opening

6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

and closing of one duplex circuit will be noticed on other duplex working from same battery at the distant station but not so appreciable at the station where the battery is the remedy for this is obvious the authors duplex Relay a description of which was published in the Telegraph Several years ago was at first adopted by Mr Stearns but Subsequently abondoned for the Siemens Bolske Double coil relay the former consisted of two magnets facing each other with the armature between them the defect of this relay is that a perfect balance cannot be obtained as the approach of the armature towards one on the other magnet disturbs it and reason which is that if a given current is sent through line coils of magnets one of wich is partialy magnetized the latter will change sooner, A difference - the quantity of the iron or in the length of magnet or the reciever of convolution owing to self induction will occassion difference in the charging and discharging times of the 2 Magnets if the equalizing magnet is adjusted nearer the armature then the line magnet and the difference being equated for by increasing the resistance of the circuit in wich the equaling magnet is placed the effect of the close approach of the armature will increase the Secondary charges within the equaling circuit and increase the dis charging or discharging time if all these conditions could be compensated for this form of magnet would undoubtedly be

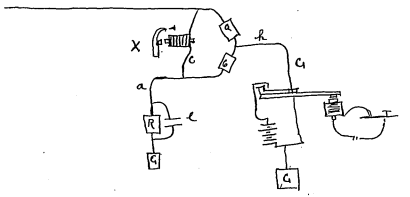
6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

Shuttin them No 11 the double Coil as no Currents would be induced into the Secondary on equaling circuit by the primary main line Coil Mr Stearns has recently introduced a Modification of his duplex which modification Consists in placing the receiving instrument in the bridge wire of the wheatstone bridge the advantages of this modification over the other plan is short it does not depend upon the — of the apparatus employed it will work as well with a minor galvanometer as with the ordinary morse relay no special form of apparatus is required Except resistance coils the disadvantage is that the receiving instrument is rendered less less delicate a portion of the working current need from the distant station passing through the Shunts around it the main disadvantage being that the Shunt from a route for the discharge of the inductive currents of the receiving instrument thereby Enormously increasing the charging and discharging them of the receiving — A. B. are adjustable resistance coils which independant of the other connection form a Shunt around the receiving instrument D is the artificial line — R the rheostant for make the resistance Equal to the line C and E the condenser to produce a Static charge upon the artificial one to balance the static charge upon the regular line H is the battery wire Placed at the central point of resistance of the Shunt CT is the usual ~~device~~

"In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

No 12

for connecting and disconnecting the battery if the rheostat R is adjusted so that it shall have the same resistance as the line wire and the condensed E has the same if the receiving — be a mirror galvanometer the induction currents generated are very weak and will scarcely disturb it working but if the ordinary Morse relay is used the induced currents are produced a mutalation of the Signals shorten the cores of the receiving magnet and the less the self induction figure 2 shows this method

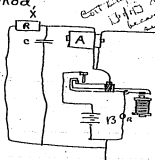


— Capacity as the line there three are two wires one one side of the instrument and one on the other side of the instrument both having the same resistance and — capacity if the rheostate A B are equal one resistance and the battery is connected to the bridge by the upward movement of the Saunders lever at

6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).

In a Duplex apparatus by ~~messages~~ Signals can be which transmitted messages in opposite directions the main feature is to neutralize the effects produced by the outgoing current upon the receiving instrument. The second feature is to keep the main line at a constant resistance, ~~The first was~~ This result was first obtained by Mr Stearns on the ordinary Latigh circuits, The mode of obtaining ~~signalling through~~ a constant resistance devised was ~~invented & patented~~ by Moses G Farmer many years ago This ~~& subsequently mode has~~ ~~been~~ adapted by ~~Mr~~ Stearns,

Stearns method



Pages 1-7 of (6a) in Edison's hand. (11 pages).

No 2

A is the Duplex relay for receiving the signals from the distant station, it has double coils wound around its cores in opposite directions to each other, so that the current from the battery B passes through one helice in one direction and through the other helice in an opposite direction, One helice is in the line wire the other helice is in an artificial line of the same resistance ~~as the line wire~~, made so by a set of resistance coils X If the line on which this Relay is placed is but a few miles in length. the artificial line composed of resistance coil will exactly imitate and produced the same effect as the line wire, ~~and of~~ when the resistance of both are equal, The battery B when ~~connected to the line~~ thrown on circuit by the although ~~closing~~ of the sounder lever, transmits a Current ~~both on~~ of the same strength upon the regular and also upon the

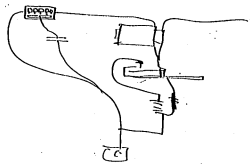
the artificial line. These Currents passing through the two helices of the relay tend each to produce a magnetism in the Cores opposed to each other energetically no effect is produced upon the relay; but an excess of current due to the battery at the Coming from the distant station passes through one helix only hence the relay responds to any excess of Current either on the regular or artificial line.

Now if the line be an open upon which the relay is placed is long. The artificial line has an extra effect produced which is not produced upon the artificial line although both may have them same Resistance - Therefore to This extra effect is called static induction - and this static induction must be produced upon the artificial line before an exact balance can take place -

~~If in this arrangement the regular line as extra artificial line is substituted for the regular line~~

To produce the same static charge upon the artificial as upon ~~the~~ line is produced upon the line, a Condenser ~~must be connected as shown on fig 1. The capacity for generating a~~ static charge Mr Stearns inserts a Condenser in the manner shown in figure one. When the current from the battery B is thrown upon the line regular and artificial line. The line and condenser both produce a static Charge in the same direction, as the battery Current. Balancing themselves in the double helices of the relay While the battery remain on the line. & (which is in fact Condenser) become statically charged so that when it is disconnected a static Charge flows out of the regular artificial line wire and artificial

line in the apparent direction
of the Katan Current, but as
before owing to the reverse direction
of the two coils in which the
wire on the Duo Relay is wound
the neutralize each others effect
on the relay. But if the discharge
from the Condenser may be varied
as shown in figure 2. ~~XXX~~ by
Connecting it at different points of
potential
potential



It is obvious that This method of
Connecting the condenser does not
produce the same effects as that
produced upon the line, the difference
is scarcely noticeable upon short lines

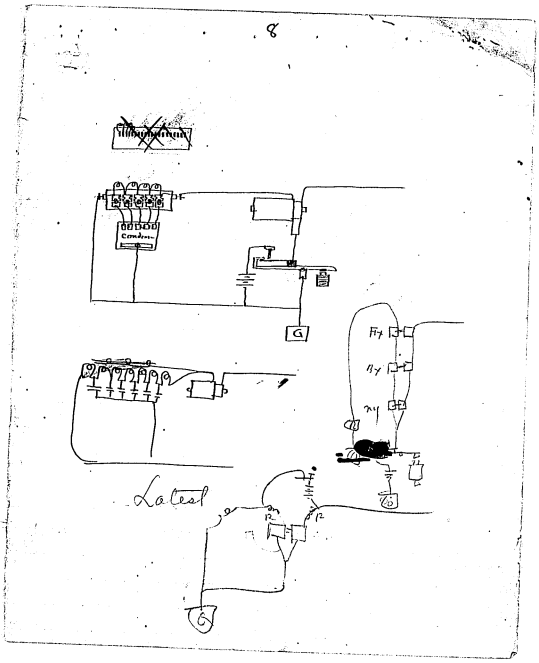
and the imitation is practically
Different. but when the line is
very long and its static Capacity
very great. this method of Connecting
the Condenser does not give perfect
The Line itself being a Condenser
or accumulator of static Electricity
distributed along its Entire length
It follows that each successive
mile from the Coil receives less the charge than
the one before it. but the Condenser
of the artificial line
is immediately Charged, being in direct
Contact with the two poles of the
battery. When the battery is disconnected
the condenser is quickly discharged
but not so with the line it must
discharge the static charge accumulated
at a distance from the battery must
pass through a resistance which of
itself is an accumulator of static
Electricity. This charge will flow
out of the line some time after the
Condenser on the artificial side has
discharged itself which it does through

6b) Pages 1-7 of (6a) in Edison's hand. (11 pages).

7

no resistance this will of Course throw the two Circuits out of balance and interfere with the signals from the distant Station it will the effect being to strengthen & weaken these signals as for instance the letter A ·— on closing & opening would be recorded ·—

To more closely imitate or produce the Conditions of the main line upon the artificial line the Resistance Coil Rheostat should be composed of a large number of small resistance Coils. between which a few leaves of the Condenser is inserted ; this will distribute the static accumulation at a great number of throughout the whole length of the artificial line and the time of charge and discharge can be made the same as in the main line. Fig 3 shows this Method =



6b) Pages 1-7 of (6a) in Edison's hand. (11 pages).

It is obvious that of the phenomena ~~a lines of great length and of great static capacity obtained upon~~ upon the line any Telegraph Circuit is exactly emulated or and produced upon the artificial ~~Line Connected to~~ circuit that we will produce a perfect Duplex Telegraph as far as regards this one particular = It is Known that when the two circuit have been balanced of an ordinary relay is inserted in the regular line. the balance will be partially destroyed owing to the inductive discharge from that relay. But if another relay of the same kind and of the same Resistance is inserted in the artificial line. this effect is equated for, But this relay in the regular line will weaken the first part part of a dash rececved upon the relay from the

6b) Pages 1-7 of (6a) in Edison's hand. (11 pages).

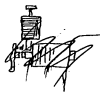
distant station and prolong it after the battery has been disconnected at that end. But this effect is not so noticable as that produced by destroying the balance,

There exists another defect in this form of Duplex which is the cause of considerable trouble which is the self induction after the Relay itself. There is of course no self induction due to the outgoing battery but. The helice of the ~~Current opens Artificial Circuit~~ with the incoming battery the case is different.

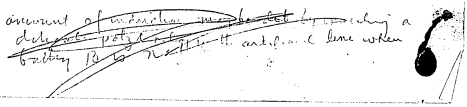
The helice ~~conn~~ within the artificial Circuit acts as a secondary Coil and the helice connected to the line + operated by the distant battery forms the primary. The accumulators connected to the artificial line serve to augument the strength

6b) Pages 1-7 of (6a) in Edison's hand. (11 pages).

of the inductive waves induced into the secondary helix by the primary were there no accumulators, connected to the artificial circuit the strength of the wave would be little but these serve to increase its strength ½ which reacting upon the relay makes the received signals very irregular. the amount of induction may be determined by inserting a dielectric plate, the author dispenses with a condenser upon the to obtain an artificial line, and produces the same effect by the inductive action of an Electro magnet. Fig 4 shows this arrangement.



polarized

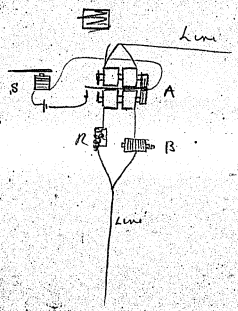


Induction Relay.

This is a very effective and delicate Device and is found to work well in practice. It is a near self adjusting magnet & will work between the greatest extreme of strength power without requiring adjustment and has the peculiar advantage of working under any Condition, it is far more delicate than the same relay worked by induction from a secondary Coil for in the latter Case the induced Current is of very high tension & very weak whereas in the former Case the strength Current is of a tension not much greater than the main Current &

7a) "Induction Relay." (9 pages; incomplete; Edison's hand).

has almost the same power
figure — shows the device



A is the polarized Relay with
double helix preferably.

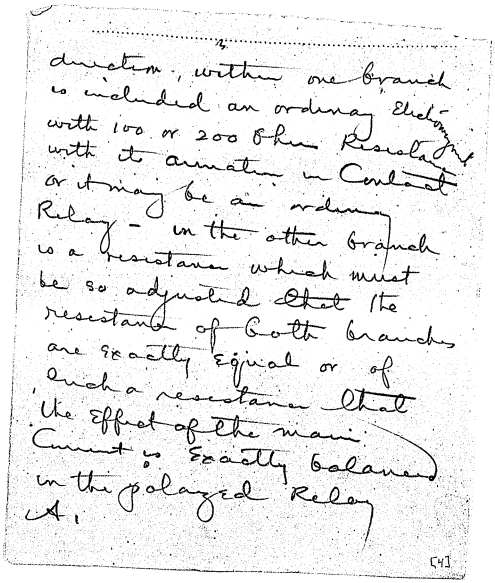
7a) "Induction Relay." (9 pages; incomplete; Edison's hand).

~~wound~~ two wires wound side by side the current which passes through ~~each~~ in opposite direction like a Duplex but shown as seperate bobbins so as to convey a clearer idea of the Connections

The two pair of bobbins are thrown so that the current in one branch of the main line shall pass through in one direction while the current in the other branch shall pass through in an opposite

[3]

7a) "Induction Relay." (9 pages; incomplete; Edison's hand).


4.

duction, within one branch is included an ordinary Electromagnet with 100 or 200 ohms Resistance with its armature in Contact or it may be an ordinary Relay - in the other branch is a resistance which must be so adjusted that the resistance of both branches are exactly Equal or of such a resistance that the Effect of the main Current is Exactly balanced in the polarized Relay A.

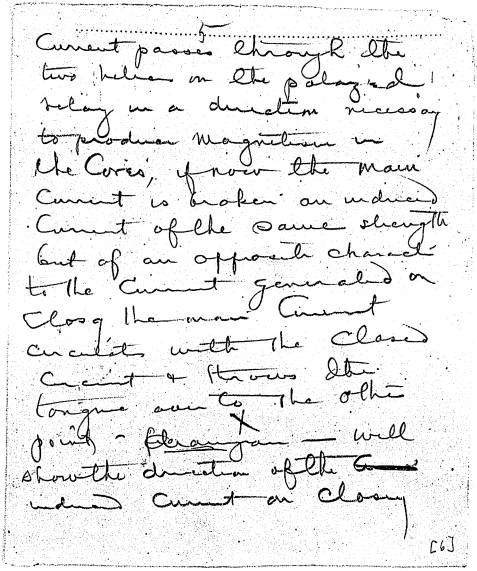
[41]

7a) "Induction Relay." (9 pages; incomplete; Edison's hand).

If now the plain resistance was substituted for the magnet B. opening & closing the main Current would produce no effect on the polarized relay: but when the magnet is in the circuit on closing the ~~C~~ Main Current an inductive discharge from the Magnet B circulates within the local circuit (as far as the induced current, Current) the first part of which is nearly as strong as the main Current, this Current ~~pas~~ unlike the main

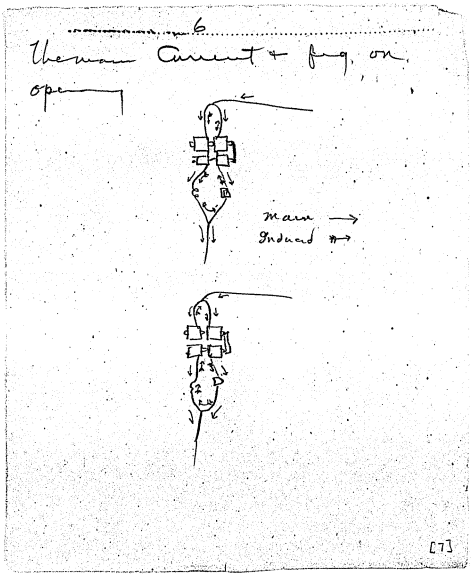
CSJ

7a) "Induction Relay." (9 pages; incomplete; Edison's hand).


Current passes through the two helices on the polarized relay in a direction necessary to produce Magnetism in the Cores, from the main Current is broken an induced Current of the same strength but of an opposite character to the Current generated on Closing the main Current circuit with the Closed Circuit & throws the tongue over to the other point - Figure 1 — will show the direction of the induced Current on Closing

CGJ

7a) "Induction Relay." (9 pages; incomplete; Edison's hand).



7a) "Induction Relay." (9 pages; incomplete; Edison's hand).

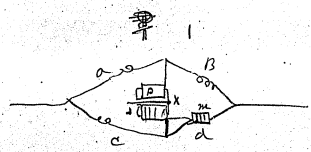
7

The polarized relay is self adjusting for any current above which does not fall below the point which it becomes necessary to produce an induced current to move the polarized tongue -

The induced magnetism may be increased by increasing the Resistance, or length of magnet & decreased by decreasing the armature from the face of the Coil shortening the magnet or reducing the resistance. This relay will give good signals with 10 cups of battery at each end of a 300 mile No. 9 wire Circuit [8]

7a) "Induction Relay." (9 pages; incomplete; Edison's hand).

in ordinary weather -
figure shows another plan
whereby the double Coils are
dispensed with -



The Resistance of all the
branches a & c d
are equal; When the
main line is closed no
Current Except the induced

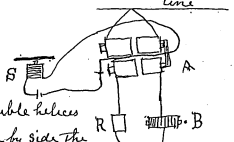
[9]

7a) "Induction Relay." (9 pages; incomplete; Edison's hand).

No 1 Copy Original by THC

Induction Relay

This is a very effectual and delicate device and is to found to work well in practice as a magnet it will work between the greatest Extremes of battery power without requiring adjustment and has the peculiar advantage of working under any condition, it is far more delicate than the Some relay worked by induction from a Secondary coil for in the latter case the inducted Current is of very high tension and very weak where as in the former case the current is of a Tension not much greater than the wave current and has almost the Some power— figure shows This device



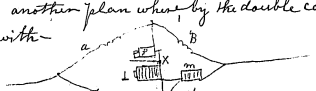
A is the polarized Relay with double helices preferrably two wires wound side by side the currents which passes through each in opposit direction like a Duplex but shown as seperate bobbens so as to convey a clearer idea of the Connections— The two pare of bobbins are converged so that the current in one branch of the main line shall pass through in one direction while the current in the other branch shall pass through in an opposite direction within one branch is included an

ordinary Electromagnet with 100 or 200 Ohms Resistance with its armature in contact or it may be an ordinary relay in the other branch as a resistance which must be so adjusted that the resistance of both branches are Exactly Equal or of such a resistance that the Effect of the main current is Exactly balanced in the polarized Relay if now plain resistance was substituted for the magnet B, opening and closing the mane current would produce no Effect on the polarized relay but when the magnet is in the circuit on closing the main current an induction discharge from the magnet B circulates within the local circuit (as fare as the induced circuits concerned) The first part of which is nearly as Strong as the main current this current unlike the main current passes through the two helices on the polarized relay in a direction necessary to produce Magnetism in the cores if now the main current is broken are induced currents of the Some strength but of an opposite character to the current generated on closing the mane current circulats with the closed circuit and throws the tongue over to the other point on ___ will Shew the direction of the induced current on closing

No 9 Copy

The mane Current fig one opening

The polarized relay is self adjusting for any current which dos not fall below the point which it necessary to produce an induced Current to move the polarized longue the induced Magnetism may be increased by increasing the resistance or length of magnet and decreased by disconnecting armature from the face of the core shortening the magnet or reducing the resistance this relay will give good signals with 10 cups of battery at each end of a 300 mile No 9 wire circuit in ordenary weather — fegur shows another plan where by the double coils are dispensed with



This Resistance of all the branches, A, B C D are Equal when the mane line is closed no current except the induced currents from the magnet — pass through polarized relay, P, This current circulates in the closed circuit formed by the Wires, B D, & X The induction changes may be increased in Strength by replacing the resistance in the branch on with an Electromagnet of the same resistance

No 4

It will be seen that one of the branches must contain a device which will generate induction currents while the other branch must be a neither of non production of these currents were it other wise both branches containing Electromagnets these induced currents would not circulate within the circuit formed but pass on the line

7b) Transcription of (7a). (4 pages).

No 2.

Morse Telegraph contends with Line

1 Secondary battery action

2 Static charge

3 Earth current Battery current

4 Earth currents — action of light on the whole

5 induction — polarization battery.

6 cross fire

7 Variability of

8 polarization leakage

9 Leakage

10 Relay discharge

11 Earth currents

12 These one with another produce Secondary phenomena

Instrument

1 one Self discharge of relay in leakage deterioration

2 oxidization of points

3 Shaking of relay points

4 magnets time of local magnet

8a) "Morse Telegraph contends with Line," page 2. Transcription. (1 page; incomplete).

6. Friction of moveable parts
7. Double Currents due to rebound of key lever.
8. Oxidization Key points,

It is very probable that the moisture on a insulator when but slight that the passage of a Current repells each globule or breaks it up in small globules repellant of each other & thus impede the Current give a momentary charge (10) Slate

8b) This appears to be a continuation of (8a) in Edison's hand. (1 page).

Nozi

4 of Movable parts

7 Double currents due to rebound of Key levers

8: oxidization Key points

It is very probable that the moisture on a insulator where but slight that the passage of a current repells Each globeules and breaks it up in Small globeules repellant of Each other and then breake the current give a momentary charge (10) States

8c) Transcription of (8b). (1 page).

No 1

Chemical paper well made Iodide paper should give a mark through 500 000 ohms with one Daniels cell — The Resistance of Iodine paper is when moved continuously to prevent insulation of the Styles by free iodine is another resistance decrease as the battery increases See if so Manganese salts have much less delicacy than The most inferior ferrocyanide paper The most perfect working is obtained when it is almost dry for Then there is no Spread of writing and no mechanical attenuation which although extremely slight with Iodine Solutions get Effect and give the Signals a pointed appearance Attempts have been made to substitute a recording roller in place of the points so as to allow of a greater press but unsuccessfully on account of the covering of Chloride Matter which it receives when the first Signal is sent — when Sulphanet of Potash is used polarization of the pens greater than with the ferrocy and the Sulphocide of iron which Still remains on the pen after a Signal insulates the pen and it is not insulation until the current has passed for some Time through breaking down the insulation ammonia chloride Sal 2o a gill of water add teaspoonful nit Ammonia to This add what is held on small Knife blade of arrow chlor Sodium the paper is white with iron pen marks are blue with tin pens they are yellow at first but soon turn

 "Chemical paper . . ." Transcription. (3 pages).

No 2

Principle – (Purple of cassius) the sensitiveness increased by adding slight amount of bichloride mercury less than ammchloride sodium but there appears after a few hours a continuous line running through the signals the Chl sodium does not answer as well as the Nitrate of Ammonia the Excessive amounts of Iodide of potassium which is necessary to be used to give delicacy to the paper led me to believe that only a certain ammount was necessary to give a good mark the Excess merely acting to reduce the resistance of the paper but I found that by using less Iodine and adding conducting salts in the same proportion as the lesser amount of Iodine that the sensitiveness was reduced to the proportinat amount of Iodine in the paper the Signals recorded on Iodized paper when quite damp fade within one hours but if really dry paper is used the marks are perceptable for several weeks afterwords varnishing the strips to prevent the air from comming in contact with the free Iodine does not prevent the disappearance of the marks – with the fused Cyanide Solution of a little Starch be added the marks have a deeper color – The resistance of very dry Iodized paper through Through a meson gal of 3500 ohms is will one cup 50 000 will five cups 100 000 Iodized paper will show a good black dot with one cup of battery Through

No 8

one Million ohms in 6 Seconds will give cups it gives a good continous marks capable of recording 100 words per minnut decreasing the thickimes of the paper does not probely decrease its resistance

of Sulphocyanuede of potassium to which is added Hydrochloric acid or muriat Tin—

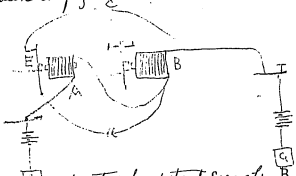
Quit formale white marks be recorded on Read back grauund Logwood wood Solutions find out more about = ft sometimes occurs that in compass galvanometer having a glass cover and insulated that the needle is attracted to the Metalic index this is caused by cleaning the glass with a cloth the glass becomes Electrically Exerted and the needle is attracted ft may be discharged

9) "Chemical paper . . ." Transcription. (3 pages).

No 1

In the American System of working by permanent currents considerable difficulty is experienced in doing weather from the escape current on leakage especially at terminal stations This current which is in proportion to the leakage becomes so powerful in wet weather that the armature must be moved a considerable distance from the face of the cores to obtain a practical adjustment and also to reduce the Self induction of the magnet it self the latter being the main trouble as the ground on one side and the combined derivations on leakage on the other side of the relay in which the induced currents can circulate hence placing the armature at a greater distance from the cores reduces the Strength of the Self induction at the Square of the distance it also brings the armature out of the influence of the permanent current. but at the same time the magnetic Effect of the received currents is reduced at the Square of the distance On wires of very bad insolation and on which relays of considerable Length are used the distance of the armature from the face of the cores Sometimes must be $\frac{5}{8}$ of an inch to obtain a practical adjustment hence not one tenth of the current is utilized which could be if the armature was nearly in contact with the core, the Shorter the cores of the magnet is the nearer the armature may approach the higher the resistance the greater

will be the effect of the leakage current numerous attempts have been made to render the Effect of the leakage current nugatory on the receiving relay among which may be mentioned Kames and Smith. Kromeins device is described in Dirk Scheller and Sabine Smiths device is shown in fig —



A. is a relay magnet L adjusted for distant Signals B is another relay which may work an ink recorder or act as a Sounder &c both are in the main circuit when the current ducted the distant battery ceases the armature of the relay A. flies away from magnet and makes contact with the points E. and Short circuits or Shunts the Magnet B. by the wire C. D. when the distant current is at the relay lever of A. is drawn forward the Shunt is removed and the current due to the Escape and distant current Energizes the Magnet B but a local might be passed through the magnet B. and produce precisely the Same Effect and it still leaves the evils above Enumerated untouched in this [10] (1)

10) "In the American System . . ." Transcription. (2 pages).

Market Printing Telegraphs.

Within the last few years an entire new branch in the class of Telegraph instrumentation has been created in this Country. ~~The latest market~~ ~~the~~ All the ~~last~~ quotations of the New York Stock Exchange are distributed to upwards of 1000 brokers Offices during the day from a Central Office by means of a ~~Modification of the Original House Printing Telegraph~~ dimunitive step by step printing Telegraph instrument, and they have proved of great value to the Commercial Community as well as a source of profit to the Companies who Operate them. At the present movement there is about $ Million of dollars invested in this Enterprise branch of Telegraphy there are several Classes of printers used. ~~The~~ Descriptions of which are based on the details of the author with the exception of

11) "Printing Telegraphs." (9 pages; Edison's hand).

2 printing

one,

In a printing telegraph it is necessary to perform two distinct Operations one to rotate the type Wheel and actuate the printing lever. The manner of accomplishing this result over one were are mostly described in fig. (. . . . . Chapter on Movements ——— figures ——— ——— ——— ——— ——— Shows more clearly the application of the principle of the instruments which have produced the best results. Have adopted, fig - is the first self acting one wire machine of this class invented, and although not at present greatly used, on account of the Capricious action of the polarized sounder is undoubtedly the most perfect device for producing two movements at a distance, one wire by Magnetism

11) "Printing Telegraphs." (9 pages; Edison's hand).

Sprunli

as it does not depend upon or an even
& rapid transmission of waves to effect
the result & but will act with the slowest
as well as the most rapid pulsations,
for the thus device no apparatus is
for the plan is already described in a
previous Chapter (Fifty) Suffice it to say,
that when Positive Currents are transmitted
(10) uninterruptions of a permanent Positive
Current. is made the polarized bar of the
polarized Switch magnet is thrown to that
side which shunts the Printing Relay
magnet out of Circuit. and grounding
nothing interferes with the proper action
of the polarized bar Switch, This magnet
which would never become active until
a negative Current was sent when
the Switch bar would fly to the other
side of its Contact point & shunt the
type Wheel magnet. One of the reasons
why these Switches were not possible
on their action was that the old bars

11) "Printing Telegraphs." (9 pages; Edison's hand).

4 prints.

were not sufficiently magnetized for
of pole of a permanently magnetized bar
be actuated by a very strong magnet.
the force with which it will be moved
will be in proportion to the magnetism
in the bar, if it were an iron bar and
Centered between the two magnet Cores.
The Centering of one Core would be to
pull it one way and the limbering of the
other Core to pull it the other way
now hence it would not move
but if it have a slight direction force
or permanent magnet it will be drawn
with a force to one pole or the other, accordg
to the polarity of the magnet. with a
proportionate to the permanent magnet
no matter how along the magnet may
be. This was not well understood when
the polar switch were first introduced and
the permanent magnetism was so feeble
that the most powerful Current in the
Quadruplex magnet would the bar would
scarcely make Contact with the
right or left point necessary to

11) "Printing Telegraphs." (9 pages; Edison's hand).

1 Printer

shunt the magnets and produces the desired results, Another defect was that the lightning depolarized the switch bars & necessitated remagnetization - from this reason Instruments using this device have now been almost abandoned With strongly magnetized bars this device is as reliable as any device used in Telegraphy

(Note mention that owing to the small quantity of electricity [illegible] no evil results are produced by the [illegible] of the switch bars from one point to the other even when in [illegible]

~~In abandoning the polarized switch~~

Fig. Shows an entire new principle for obtaining the two movements on one wire and this principle has now been adopted in all the one wire machines now in use. This principle is based on the fact ~~discovered~~ noted & [illegible] by the Author that when rapid reversals were transmitted within a closed Circuit Containing an Electromagnet and on a polarized

11) "Printing Telegraphs." (9 pages; Edison's hand).

6 pages

magnet the lower of the polarized magnet would be subjected with the considerable force while the attraction of the ordinary Electromagnet for its armature would be scarcely perceptable,

This device is shown in figure —

The author first used a very short. ~~Electro~~ polarized magnet. one of the primary in Conjunction with a long Electromagnet but subsequently added a shunt around the Long Electromagnet equal in Resistance to the magnet itself, ~~etc~~

Without the shunt it requires that the reversals should be sent within the Circuit at a Certain Speed after any known speed will allow the Electromagnet to act. But with the shunt. The discharge of the Electromagnet itself would be prevented from acting against the polarized magnet & reducing its power but circulating within the Closed Circuit formed by the Shunt & the Wire of the Electromagnet

11) "Printing Telegraphs." (9 pages; Edison's hand).

7 Printer -

overcomes enormously its charging & discharging time hence very slow reversals may be sent into the Circuit without any danger of actuating the lever of the Electromagnet The shunt device is shown in fig 1.

This principle has been adapted in what is known as the Manhattan Printer but with slight modification

This is shown in fig C is a separate Electromagnet prevented from working by the rapid reversals A A is the Polarized magnets operating the type wheel B the printing magnet. When rapid reversals are transmitted the lever of A A respond & the type wheel is rotated but the Electromagnets C & B for the reason above explained as before do not respond until the Current is made permanent. when this takes place the lever of C

11) "Printing Telegraphs." (9 pages; Edison's hand).

is drawn down and the polarized magnet is short circuited, thus decreasing the resistance of the circuit and the Magnet B becomes more powerful & gives a better impression upon the latter, of Course the Extra magnet C may be dispensed with without in the least Effecting the result,

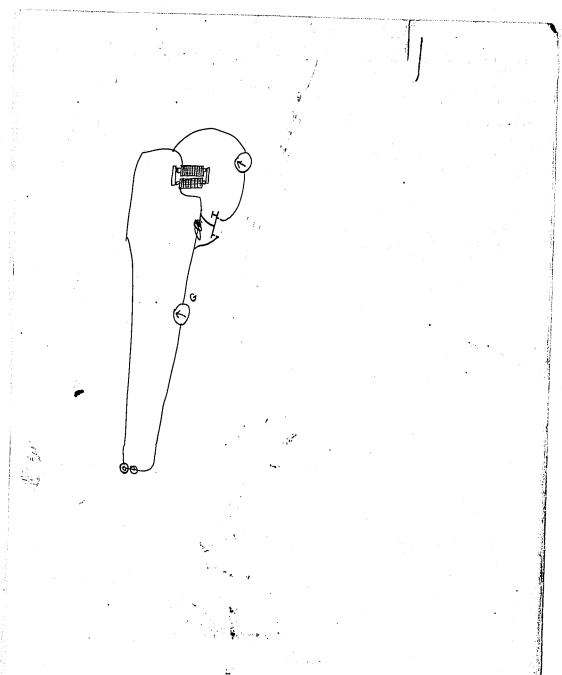
Figure — Shows another plan in which the magnets are not polarized, When there is no Current in the Circuit the type wheel lever is drawn up by the Spiral spring and Contact is broken at x-m. Throwing the printing magnet out of Circuit now when ~~a~~ pulsations ~~of a given length~~ are sent which are sufficient to operate the the type wheel magnet into lever & no more the printing magnet will remain quiescent as but a small portion of the pulsation passes through it ~~as above~~ but as the Current becomes permanent the sufficient

11) "Printing Telegraphs." (9 pages; Edison's hand).

will pass through 9 points to bring the printing lever up and effect the impression upon the paper.

To finish this article get points from General Patent Fun Box Document.

11) "Printing Telegraphs." (9 pages; Edison's hand).



11) "Printing Telegraphs." (9 pages; Edison's hand).

Break wheels.

Figure 2 represents shows a form of break wheel up which where the rubber or insulating substance between the teeth are dispensed with, and a limiting pin substituted, A,

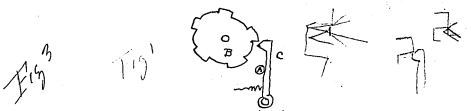


Fig 1

This prevents the click C Entering the click C is prevented from getting too deep between the teeth of the break wheel, A, there are great depth in the spaces between the teeth of the break wheel A, The defect of this break consists in the wearing away of the point of the click which the pressure is increased as more insulable substance is placed between the teeth of the break wheel. The point wearing squares is liable to catch the sq edges of the teeth on the wheel, & the edge of these teeth or the roundedness of the teeth then the time or length of Contact will be shortened as the point of C wears another objectionable feature

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

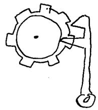
12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

Break wheel
2

is the pin ^A^ a which moved in the slightest manner will increase or decrease the Length of Contact, in ~~Printer Step by Step~~ printing Telegraph work this adjustability of Contact surface is Especially abjectionable ~~as a number of instrument~~ ~~as it frequently~~ ~~in one circuit adjustable for one length and it will be~~ [illegible] ~~they a very simple variation of length of contact~~ ~~happens, that several instruments~~ as these they a change in the length of Contact will ~~create~~ change the adjustment of the vibrating levers,

~~Another form is shown in~~ ~~If a roller is subst~~ Another form of Breakwheel is shown in fig 3

4



in this arrangement the ^Limiting^ pin A ^shown in fig 2^ fig 2 is dispensed with ~~a~~ The Contact lever C is provided

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

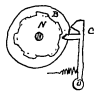
12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

3 Break Wheel

with a second point, which rubbing on an insulated wheel prevents the click from entering too deeply in the spaces As the wear on both points can be made nearly the same the length of contact remains unaltered

Another form is shown in figure 4.

Fig. 4.



B is a smooth (faced) wheel the surface of which is covered with platinum to prevent excessive oxidization

N is a toothed wheel insulated from B This wheel is provided with as many teeth as there are Contacts to be made (in one system) C is the Contact Lever provided with an extra tooth X running in the path of the wheel N. These teeth the movement given to the latter wheel by the teeth on the of N control the length of the breaks The spaces between the teeth should be shallow

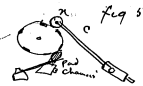
12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

and the two points 4 Pk wheel
that when contact is being made the tooth
X should not touch the bottom of the space

with the platinized gutta percha ~~pa~~ pegment
the point X from dropping to the
bottom of the spaces in the wheel
M. ~~the~~ ~~Tooth~~ may wear on the points q.
will ~~not~~ be ~~after the length of~~
~~Contact~~, about the same

Another form is shown in fig 5



(6)

The rubbing contact point
~~pecat~~ shown on the ~~previously~~
discribed break wheel is to be replaced
by a wheel M. This has great the
~~obtained~~ by using a wheel is that
advantage ~~as there is no rubbing~~
~~Contact~~ it will give a better contact, and it will clean
~~Contact~~ and ~~it will~~ ~~require~~ ~~much~~
and with the same pressure a the rubbing contact it will not have
less pressure ~~to~~ ~~obtain~~ a perfect
~~Contact~~ ~~while~~ ~~X~~ Several times the
Thus assuming perfect Contact
~~pressure may be put on it without~~
~~a corresponding relandalum of the~~

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

5th Bkwl

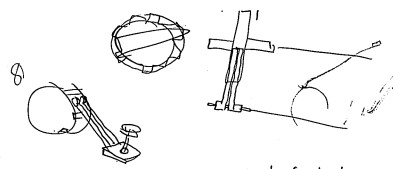
another advantage is less
~~Breakwheel and~~ wear of Contact
Joint. The foot is a very important
Consideration ~~on~~ with that class of
apparatus which have but
Can spare but little power to
Rotate the break = Where a
roller is used a small ~~steady~~ watch spring Type)
~~hair~~ ~~brush~~ should press
lightly against the periphery
of the Wheel to remove the
Oxide formed by the spark ~~for~~
and to prevent dust, Were no
brush used the oxides ~~press~~ would be
drawn over the wheel and pressed
on the platen and Surface ~~form~~
infinitissimal breaks of the
Graining of This rollers should be
Made as infeq
- Same as perf -
fuft

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

6 Bk wheel

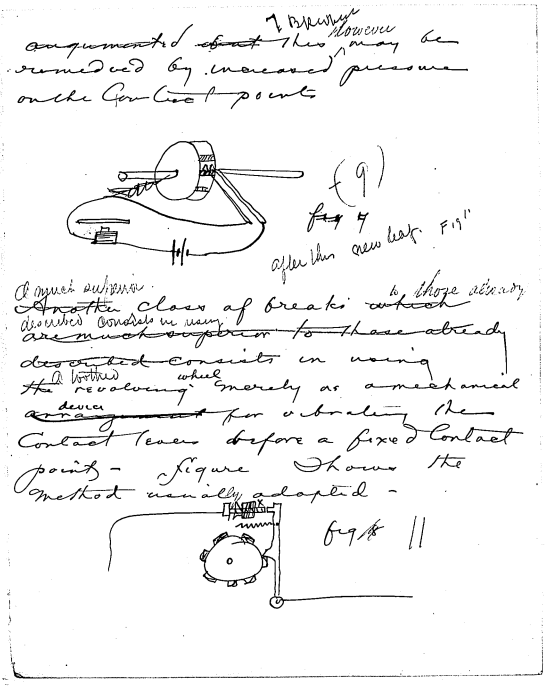
frequently two rollers or two point of Contact are used as in fig: 12.



The object being to ~~prevent~~ insure perfect Contact of Contact ~~stoned~~ one point fail, ~~but extra pressure being required then~~ of Sometimes ~~the~~ two Contact points are connected as in figure — to lessen the spark ~~which is very bad~~ when ~~short circuits with~~ low resistance Batteries are used. This method is very effective ~~on inductive~~ for that purpose the spark, ~~or~~ ~~decreasing it~~ at least two thirds ~~but the~~ ~~Liability of bad Contact to~~ make

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).



12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

8 Break Wheel

The objections to this form are first. the oxidization is accumulated at one point instead of being divided over a large number of points as is the Case with the devices already described, Secondly: its Shortening of the break as the platina point are worn by oxidization, Third the rebound of the lever when it touches the rigid platina point, The Evils of having Considerable mass which are rebound when shutting a rigid point. when a low motive power is used each takes a small power thus rebound gives double breaks when only one break is wanted, (see 182 5.c) although this interruption is infinitely small. If the induction Current of the Electromagnet is very sensitive to them (see ---) hence the time of magnetization of the magnet is prolonged The Effect of this rebound may be entirely prevented by using a flexable spring as in the last method shown in fig 9

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

9 Breakwheel

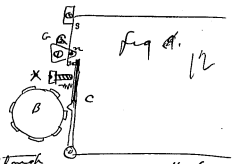


fig 9. 12

By the m although the the Cam.
contact Case the rebound of C against the
screw X (also place of support to allow
it to break Contact with the
Spring platinum pointed Spring S.
The forward or backward motion
of the spring is regulated by
adjusting the plate Q. The spring S
press with a degree of elasticity
against the pin R which is
inserted in Q -
A method superior to this consomuch
as the spark chances of a miss
bad Connection is reduced. one
Point be always preserved the
Oxidization of one of the points
being reduced to almost nothing
By a method as shown in

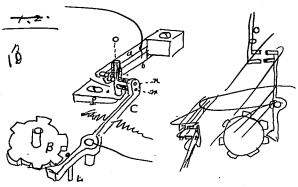
fig 16

12) (12a) – (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

10734 cubical

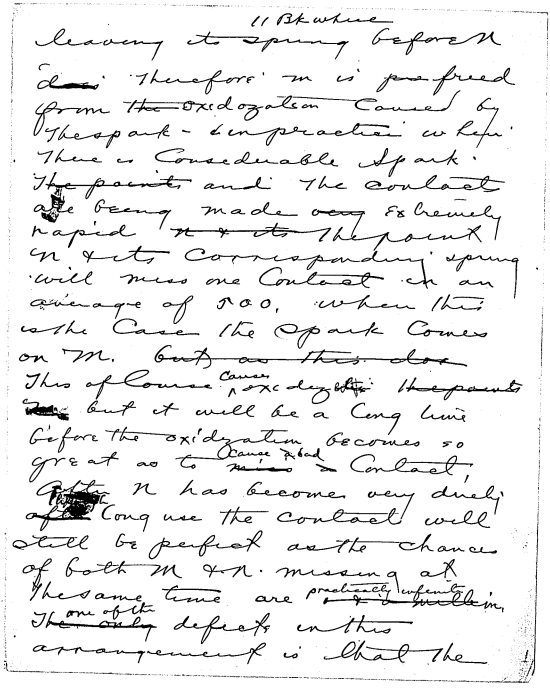
figures 12.



C is the vebrating lever. on the end of which are two platina points. one of the points being placed slightly in advance of the other a. b. are two Contact Springs both Connected together having points of the same length. These springs hug the pin O on the moveable plate P. The upper platina point n being in advance of the lower point m. Caters all the spark as it is the last point of Connection. The point m

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a) "Break Wheels." (10 pages; page 13 missing; Edison's hand with Batchelor's annotations).


11 Breakwheel

leaveing it spring before M
does. Therefore M is pre freed
from the Oxidozation Caused by
the spark - & imperaction when
There is Considerable Spark.
The points and the Contact
are being made very Extremely
rapid & its the point
M & its Corresponding spring
will miss one Contact in an
average of 200, when this
is the Case the Spark Comes
on M. but as these does
This of Course Causes Oxidization the points
but it will be a Long time
before the oxidization becomes so
great as to Cause a bad
Contact,
M has become very dirty
Long use the Contact will
still be perfect as the chances
of both M & N. missing at
the same time are
The only defects in this
arrangement is that the

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

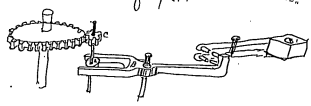
12 Bk wheel

length of contact will shorten as the point on ~~circle~~ diameter goes, -

The most perfect break in a mechanical point of view is that shown in fig 11 This is specially applied to high speeds.

fig 11

14



~~As with other breaks the~~ ~~Teeth length will vary with~~

The Contacts are made as in fig 10. ~~But~~ But the toothed wheel which gives motion to the vibrating lever the length of vibration of which will vary as the rapidity of rotation of the toothed wheel increases or diminishes. By a gear pin & Cam wheel. A is the Cam wheel or Eccentric wheel working in the forked armature B.

113

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

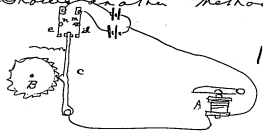
12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

Photocopy. Original is in Scrapbook,
Cat. 297, Notebook Series.

14 Bk wheel

It will be unnecessary to describe the defects of this class of Breaks as they are liable to the same defects as the Single Current Breaks,

Fig 9 Shows another Method.



14

B is the rotated wheel to give motion to the Cover C which has 2 platinum points, one of which is platina tipped, d e are two Contact Springs which may be double as in Fig 8 resting against the stop pins n n. By the rotation of the wheel B the cover C and the cam on its axis revolving between the springs against one spring & the other the I or C Battery is thrown alternately into the Circuit.

120 (3)

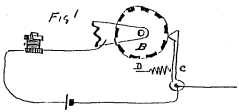
12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

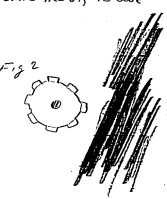
12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

/

Break Wheels.

Figure 1 shows the form most in use in Telegraphicapparatus





~~B c~~ the breakwheel B is divided as in fig 2 and the spaces between the teeth inlaid with Vulcanite or Ivory. c is the contact arm held ~~with any degree of pressure~~ against the periphiery of the wheel by the adjustable spiral spring D. The teeth of the break wheel are generally faced with thin platinum foil. The point of the contact arm is also faced with platinum by means better known to us

There are many objections to this form of break among especially when used in connection with an electromagnet, on a circuit and with a battery of low resistance, among these

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12b) "Break Wheels." Another version in Edison's hand. (5 pages with Batchelor's annotations).

objectionable features may be mentioned
1. To obtain the improper relation between the contact
surface & space,

2. The great tension or pressure ~~which must be placed on the Contact point~~ to insure
proper contact

3rd The destruction of the rubber or Ivory
by the scraping action of the Contact lever

4. ~~The insulation of the platinized teeth~~ the imperfect connection caused by
the compression of the dust from the Ivory into
the recess formed by the contact lever.
Platinum worn part with a little worn

.4 The burning of the insulation at the
point of ~~where the Contact point touches the~~ greatest connection & thereby
~~tooth~~, prolonging contact.

5. The ~~improper~~ insufficient connection between the pivot of
breakwheel & its bearing
& the shaft of the break wheel, when in
motion,

6th The excess of spark due to the
accumulation of platinum dust on the ~~face~~ as caused
by the burning away of metal ~~formed after the tooth~~,

. Regarding the first objection it may be
stated. that to obtain the greatest
number of vibrations from an armature
lever. The contact surface of the ~~Magnet~~ Mainwheel tooth

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12b) "Break Wheels." Another version in Edison's hand. (5 pages with Batchelor's annotations).

should have twice the surface ~~as the space~~ of the break, or space between ~~between~~, The reason for this is obvious when we consider that upon closing a circuit in which there is an electromagnet ~~that~~ the ~~discharge~~ secondary current ~~of that~~ magnet sets up an opposing EMF to that of the battery ~~as the magnet being on a closed~~ circuit ~~this~~ which prevents the magnet from being charged immediately, hence the extra area of the contact surface is to compensate for the action of this secondary current, When the ~~circuit~~ circuit is broken there is no route for the extra induced current to or current set up an EMF to prolong the time of demagnitization, If a very long magnet is to be used the length of contact should be still greater, ~~But if the resistance of the circuit is increase~~ The resistance of the circuit upon which the magnet is placed as well as ~~to~~ the length and number of convolutions of the wound, has an important

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12b) "Break Wheels." Another version in Edison's hand. (5 pages with Batchelor's annotations).

effect on the relative proportions ~~between the~~ of Contact surface to space, as well as the action of any ~~considerable~~ leakage arc between the battery ~~and~~ Break & the electromagnet; ~~to sum up~~ the Longer the magnet & the Lower the External resistance, the greater ~~must~~ (proportion) be the contact surface ~~and~~ to the Less the space. (See Chap on discharge in closed simple ckt)

Regarding the second objection it may be stated that the pressure of the Contact point requisite to give 3000 perfect Contacts per minute with a small number of elements within a circuit of Low resistance is sufficient to wear off ~~to~~ of an inch platinum wire ~~to~~ th of an inch in diameter $\frac{1}{32}$ in 2 Hours. On any rubbing surfaces ~~with the same~~ interruptive circuit of Low resistance & small E.M.F. ~~To~~ ensure perfect contacts the pressure must be increased directly with the speed, ~~(ie with 1 cell of battery on electromagnet one 1 ohm resistance~~ If on a perfectly smooth wheel with a (plain) Cotton cloth surface ~~with~~ a Contact point pressed ~~against~~

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12b) "Break Wheels." Another version in Edison's hand. (5 pages with Batchelor's annotations).

the ~~brake~~ wheel, be
it with a given power and turned at a
given speed. It will offer a certain
constant resistance, all others
~~Conductors being the same~~ ~~are~~
If the speed of the wheel be doubled
the resistance will be doubled
~~and so on~~ Constantly increasing with
the speed, ~~so Constant is then~~
~~resistance~~ (thus by merely varying the speed
~~by the insertion or increase~~
~~the resistance of the break wheel a Conductor~~ ~~from~~
~~a short to many thousand~~
can be increased or diminished
~~thus) either by varying the speed~~)
~~when the speed of the wheel is~~
~~Even that it has been suggested~~
~~as a measure of resistance,~~
See about increasing Element,
& calling the Resultan
Measure it in Bridge or
— Bradley —

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12b) "Break Wheels." Another version in Edison's hand. (5 pages with Batchelor's annotations).

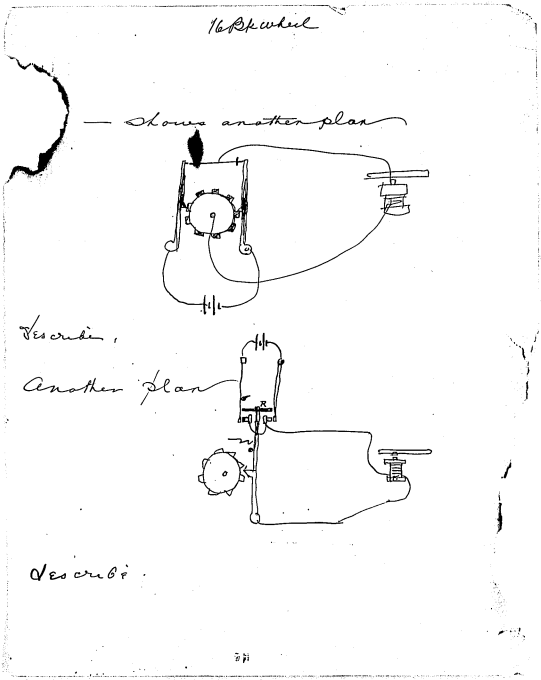
16 Break wheel -

B is the vibrating lever provided with a double platinized foot, and is connected to earth and A and K are two points both connected to the line, F & G are two contact springs. Connected to the Ends of the battery. When the point on the lever B is in a space on the wheel as between the teeth on the wheel A. a zinc Current flows to Line, when the lever B is on a tooth, a Copper Current flows to Line. This is a very effective & simple device.

Other forms may be made by using double wheels & ~~Other forms may be made by double contact~~ ~~points and levers but those already described~~

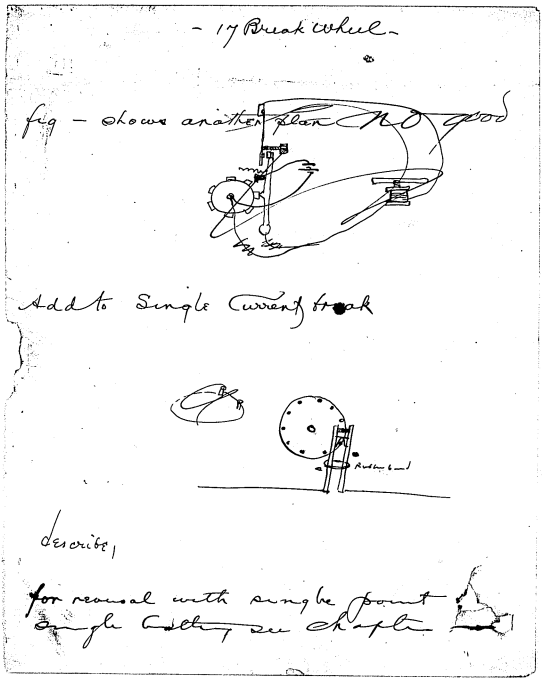
12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12c) Pages 16 (2 versions), 17, and 18 of (12a) or (12b). (4 pages; Edison's hand).



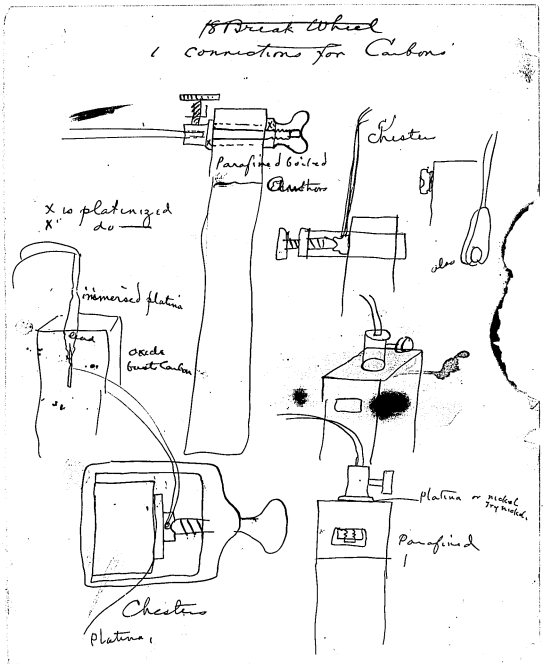
12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12c) Pages 16 (2 versions), 17, and 18 of (12a) or (12b). (4 pages; Edison's hand).



12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12c) Pages 16 (2 versions), 17, and 18 of (12a) or (12b). (4 pages; Edison's hand).



12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12c) Pages 16 (2 versions), 17, and 18 of (12a) or (12b). (4 pages; Edison's hand).

(1874)
(Proposed)

number of perfect vibrations from an armature lever, ~~The contact surface of~~ the breakwheel tooth should have twice the surface of the heart or space between.

The reason for this is obvious when we consider that upon closing a circuit in which there is an electromagnet, the secondary current from that magnet sets up an opposing electromotive force to that of the battery, which prevent the magnet from being charged immediately, hence the extra amount of contact surface is to compensate for this secondary current.

When the contact is broken there is no circuit for the extra induced current to set up an electromotive force to prolong the time of demagnetization. If a very long magnet is used the length of contact should be still greater.

The resistance of the circuit in which the magnet is placed as well as the length & number of convolutions of the magnet, has an important effect on the

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

insulated wheel prevent the click from entering too deep into the space. As the wear on both contacts can be made nearly the same the length of contact remains unaltered

Fig 4 shews another form.
B is a smooth faced wheel the surface of which is covered with platinum to prevent excessive oxidization. A is a toothed wheel insulated from B; this wheel is provided with as many ~~contacts~~ teeth as there are contacts to be made in one revolution. C is the contact lever provided with an extra arm to be moved by breakwheel A. The movement given to the contact lever by the teeth of A control the length of contact. The spaces between the teeth should be shallow & the 2 points should be so proportioned that when contact is being made the extra arm should not touch the bottom of space

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

7

Another form of breakwheel is shewn in fig 5: The rubbing contact points shewn on the breakwheels previously described is here replaced by a wheel A The advantage obtained by using a wheel is that it will give a better contact & with the same pressure will have less friction, hence the pressure may be greatly increased in order to insure perfect contact another advantage is less wear of contact point. These are very important considerations with that class of apparatus which can spare but little power to rotate the breakwheel. The rollers should be made as in fig 6. Where rollers are used a small watch spring tipped with chamois skin should press lightly against the periphery of the wheel to remove the oxide formed by the spark & to prevent dust & the oxide from being rolled into the surface of the wheel & making imperfect connection.

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

Frequently 2 rollers or points of contact are used as in Fig 7 the object being to insure perfect contact should one point fail.

Sometimes two contact points are connected as in fig 8 to lessen the spark which is very troublesome when short circuits & low resistance batteries are used. This method is very effective for that purpose lessening of at least two thirds but increasing the liability to make bad contact this however must be remedied by increased pressure on the rollers.

Where two rollers are used to insure perfect contact, the length of contact may be increased by simply moving one roller ahead of the other

Another form of breakwheel is shown in fig 9. Instead of using a tooth wheel pins are set at regular distances in the face of a smooth wheel A. CB are contact levers prevented from touching each other by the stop pins ED. Each pin on face of wheel A makes connection between CB thereby

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

9

closing the circuit.

A similar superior class of breaks to those already described consists in using a wheel merely as a mechanical device for lifting a contact lever from a fixed contact point. Fig 10 shows the method usually adopted. The objections to this break are First. the oxide is accumulated at one point instead of being divided over a large number as is the case in the former breakwheels Second. Shortening of the contact as the platenium points are worn by oxidization Third. The rebound of the lever after it has touched the point. Lever rebounding when striking a rigid point, this rebound gives double contacts when only one contact is wanted (See) Although this interruption is very small the inductive current of an electromagnet is very sensitive to them (See)

The effect of this rebound may be entirely prevented by using a flexible spring as in Fig 11

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

Although the rebound of the lever C against the pin X takes place it is not sufficient to allow it to break contact with the spring S. The stop pins W & X are adjustable thus the height of contact can be regulated by the adjustment of these pins.

A method superior to this, in which the chances of an imperfect connection are lessened is shewn in Fig 12 the oxidization of one of the points being almost entirely prevented B is the vibrating lever on the end of which are two platinum points one a little longer than the other

C D are two contact springs both connected together having points of the same length & pressing against the stop pins E F

The longer platinum point of the lever B takes all the spark as it is the last point of connection the shorter one leaving its spring before the longer one, is freed from oxidization caused by the spark. In practice when there is considerable spark

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

& the contact are being made very rapid the longer point & its correspondin spring will make one contact in about five hundred when this is the case the spark comes of course on the shorter one This of course causes oxydization but it will be a long time before it becomes so great as to cause an imperfect contact After the longer point has become very dirty through long use, the contacts will still be perfect as the chances of both points missing at the same time are very small As the length of contact shortens as the points oxidize it must be adjusted by the stop pins E F.

The most perfect break in a mechanical point of view is that shown in Fig 13. This is especially applicable to high speeds. The contacts are made as in Fig 12. but the vibrating lever is made with 2 prongs ~~forked~~ at one end between which revolves a cam which is worked by gears as shown in figure. The length of contact in this case will shorten as the speed

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

increases. A is the cam or eccentric wheel working in the forked lever C to which as will readily be seen it gives a vibrating motion not depending on a spring but positive in its action.

Another forms of positive contact break are shewn in Fig 14 & 15

In Fig 14 the lever is vibrated by means of a groove in the side of wheel A in which the bowl on the end of contact lever runs.

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

Breakwheels for reversed currents with 2 batteries

A is a tooth wheel on which the levers B & C alternately make contact & are placed so that when one is on a tooth the other is in the space; as will be seen by the connection of the two batteries in Fig 16 when C make contact a negative & when B makes contact a positive current is thrown & line. These break as easily & same depth as single current breaks

Fig 17 shows another method

B is a tooth wheel giving motion to the vibrating lever C which carries two platinum points on its end. DE are contact springs which rest against the pins m m By the rotation of wheel B the lever C makes connection with DE alternately throwing reverse currents & line

(12)

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

Breakwheel for reversed currents with one Battery. Fig 18 shews a plan.

A is a tooth wheel which vibrates two contact levers C & B one of which is on a tooth when the other is on a space. Thus:- when C is on a tooth the point E is out on contact & B being in space point D will send a current & line, & when B is on a tooth & C in space contact made at E will send a reverse current

Fig 19 shews another method:—

In this plan F & G are 2 contact springs one connected to each end of a battery & resting against the contact screws B D. The vibrating lever B carries a cross arm C on the end which when it vibrates disconnects F & G alternately from their respective contact screws. throwing reverse currents to line.

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

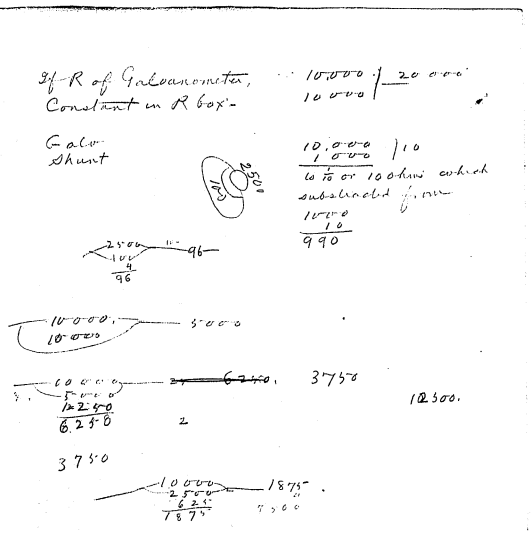
Another form of breakwheel for this purpose is shewn in fig 20

A & B are two toothed wheels insulated from each other & their spaces filled in with vulcanite or ivory, 1 2 3 & 4 are contact rollers, 5 & 6 are also contact rollers which have to make a permanent contact one with each wheel. The rollers #1, 2, 3, & 4, are so arranged that one on each wheel makes contact whilst one on each is on the insulated part. Thus in fig 20 the rollers making contact on their respective wheels the circuit is closed through rollers 2 6 5 & 1 & when 2 & 4 are making contact it is closed through 2 5 6 & 4

In making this breakwheel care must be taken to have the insulated part a little larger than the tooth

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).



12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

Another break for this purpose is shown in fig 21

B is a vibrating lever having its ends insulated from its centre, & wheel is put on motor by a tooth wheel A. 1 2 3 4 are contact springs connected to battery as in Fig 21. The two points of vibrating lever are connected to sounder or line. By looking at the figure it will readily be seen that when the lever is on the tooth of a wheel the battery is connected with the sounder through springs 1 & 4 & when it rests in the space, it is connected through springs 2 & 3 thus using reverse currents.

108 (1)

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

1874
TAE - Sketches & Notes

E-1687

In this fig the pin a is made adjustable by being placed eccentric in the end of stud

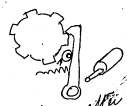
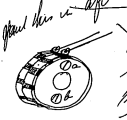
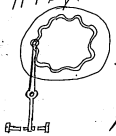


Fig 7.

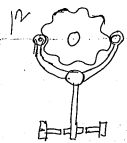


The angle of contact can be increased in this breakwheel by loosening set screws a, b & moving out a little forward.

II Fig.



This is a positive motion breakwheel a good one where we have plenty of power, it causes considerable friction

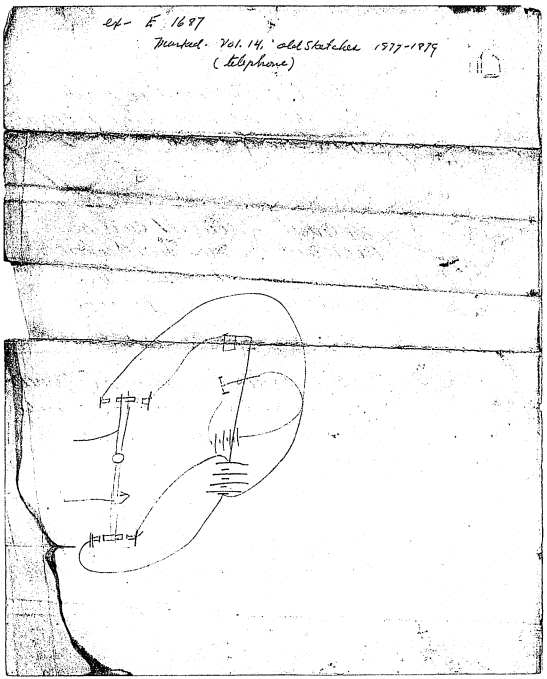


Another positive motion Breakwheel too much friction principal objec.

C.J.

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).

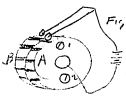


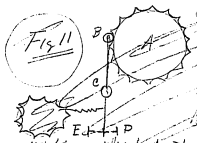
12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).

to be put in 1/2 way down]

By making the wheels A and B
Fig 10 and C serrated together
by screws 12 the length of contact
can be adjusted by simply setting one
a little ahead of the other.
Also can also reduce by setting one
Cam form of Breakwheel.





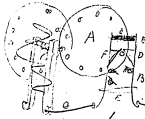
~~Fig 11 shows a wheel carried~~
~~by screw E and a Cotter~~
~~pin~~ having a roller on one end &
make a wheel A on the other end contact pawl
P close or pawl E.P.

C27

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).

Another form of Breakwheel is shown in following fig. A is wheel on spike of which ~~is stuck four~~ are fast to ~~his~~ axle material of both in face. CB are 2 contact ~~pieces~~ strips kept apart by insulated pin E ~~B. & D~~ F are the 2 contact points which are kept apart ~~fixed~~ but each other by the stop pin E. When axle is rotated each pin comes in contact with the contact points ~~at~~ D F making thereby connection from F to G.



[3]

12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).

12½

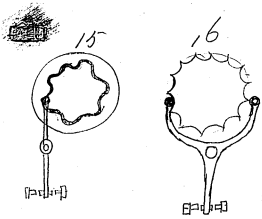


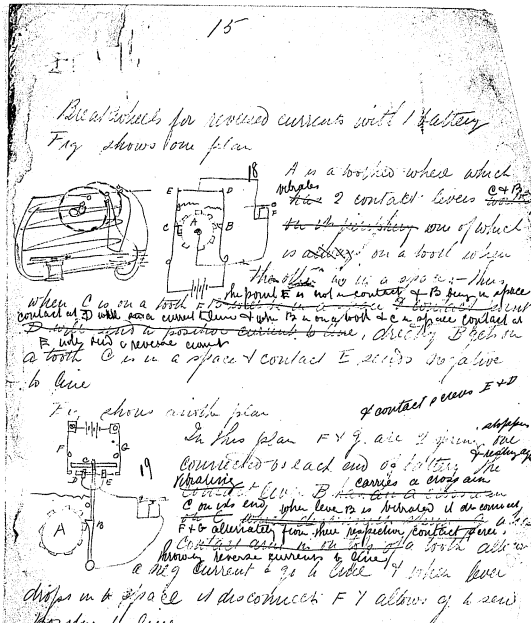
Fig 15 & 16

The advantage of this is that however [illegible] may turn it is obliged to make the contact being a positive motion independently on spring.

Fig 15 & 16 shows also positive motion breaks

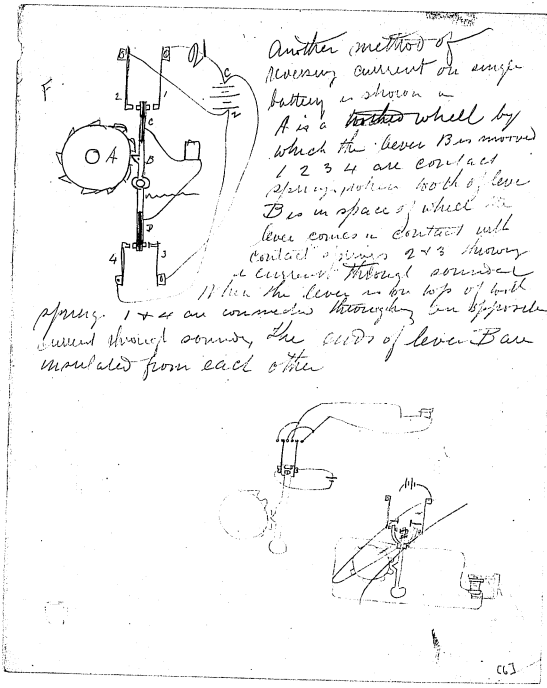
12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).



12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).



12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).

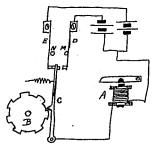


Fig 17

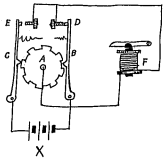
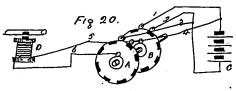


Fig 18



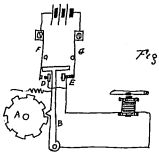


Fig 19.

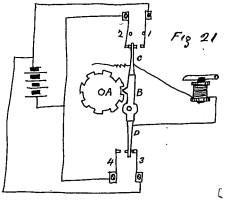
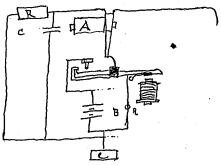


Fig 21

[7]

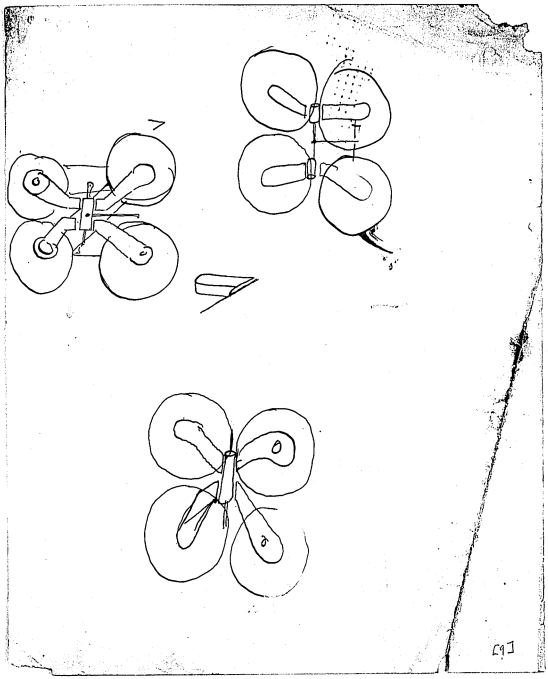
12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).



12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).



12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).

Electromagnets. (1879.)

It has been said and
written in this country by persons
who profess to understand the
laws of electricity and magnetism
about the proper dimensions and
resistance of the ~~magnet~~ used
relays under given conditions
to produce the best results.
~~Those persons Block Electricians~~
~~abuse this and that telegraph~~
~~functionary without stint for~~
~~their~~ They Criticise all the other
Cry down Ohms law as to the one to be
followed in the proportionment
of the relays in a Circuit.
When in fact to obtain the
best results without special
appliances Ohms law is the farther
we get from this means we approach
the perfection of the relays
upon dead Command
law is that law the

13) "Electromagnets." (4 pages; Edison's hand).

the result,
~~extral~~ ~~speaking~~ In nearly all instances of ~~is~~ that a want of power in the magnet that produces bad signals, It is the self induction of the magnets themselves which simulate them,
But the mutilation of signals which ~~follow~~ ~~them~~ is produced by the relays themselves by self induction in Conjunction with the ~~Stake~~ induction of the line ~~Cause~~ Make the proportionment of resistance "to obtain the greatest effective power as of ~~secondary matter~~, ~~The Main~~ importance, The main point to ~~It is well known~~ be taken into Consideration in the proportionment of relays, to ~~Counte~~ ~~as~~ their Self induction -

13) "Electromagnets." (4 pages; Edison's hand).

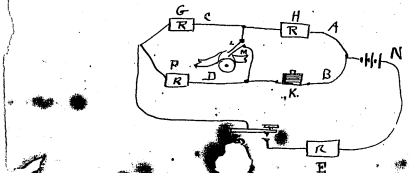
It is well known that the author employs the discharge from an Electro Magnet to Compensate for the Static Charge of the line in his Automatic System. Owing to the liberality of his associates, especially in that System he was enabled to make an immense number of Experiments on the inductive action of Electromagnets in any form and shape.

The instrument used was a Wheatstone bridge parallelogram in the bridge wire of which was a very sensative Chemical recording instrument moved by clockwork, the paper of which was moved by clockwork running at a regular speed.

13) "Electromagnets." (4 pages; Edison's hand).

The magnet which ~~is to be invested~~ tested was placed ~~This~~ resulting on the chemical paper were two recording pens one of which gave a mark by a current in one direction while the other pen gave a mark from a current in the opposite direction.

The magnet or ~~device~~ apparatus that was supposed to give an induction effect was placed in one of the bridge wires and its resistance balanced by resistance Coils This apparatus is shown in figure.



13) "Electromagnets." (4 pages; Edison's hand).

The laws which govern the charge and discharge of ~~M~~ the iron cores of an electro magnet are nearly the same as those which govern the charge and discharge of a long insulated conductor, Both are due to to the most all the phenomena in both cases are due to the ~~induce~~ production of ~~induction~~ of induction currents, which are governed by certain conditions by the ~~original~~ ~~Dynamic Current~~.

One of the laws of electro magnets is that the charge and discharge is in proportion to the length of the iron core The why and wherefore of this the cause etc I have been unable to glean from any investigations heretofore published that have come to my notice

~~It was~~ I was led from this want of data to undertake a series of investigations with the view of learning if possible ~~some~~ the Causes of some of the phenomena ~~if not the~~ noticed by different investigators

14) "The laws which govern . . ." (2 pages; Edison's hand).

(1874)
Telegraph

and discribed in works upon the ~~subject~~.
Electricity and Magnetism.

The part which the secondary or induction
Current performs in Electro magnet operation are
very complex and are undoubtedly the cause
of the anamalous results obtained by some
experimenters.

(My first experiment was with an ordinary
magnet 1½ inches (inch dia.) long wound with insulated
Copper wire. the resistance being 124 ohms
. This magnet was provided with a lever
& armature and in fact was the same as
a Relay used upon the American telegraph
Lines,

This was placed in a short circuit
Containing 10 Cups of Bunsen battery and
an ajustable rheostat, ~~to range~~ each coil
of which was 30 ohms and 30 coils

14) "The laws which govern . . ." (2 pages; Edison's hand).

9 X

The operator at the distant station to balance his outgoing current upon his receiving instrument, with out interference from this current from V.W.

C is the receiving apparatus and is the same as that described in the Duplex Apparatus.

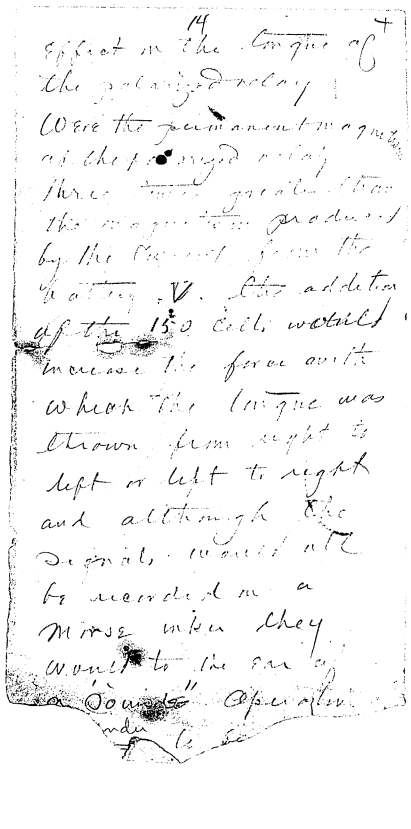
F is a second Electro magnet & lever operated by a Local current Local Battery B4 Key U

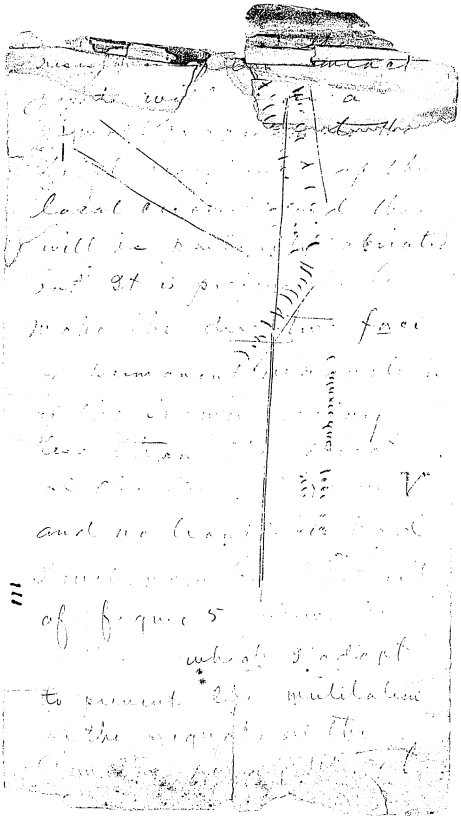
When the Key U is open the lever of F is drawn away from the magnet

15) Incomplete essay, pages 9, 12, 14, and a damaged page. (4 pages; Edison's hand).

simple mechanical apparatus is known as the operator ~~[illegible]~~ with the key U the Closing the key U the battery W of 150 cells is thrown in circuit and the coil L[8] thrown out of circuit. (the preceding resistance equal) and the total battery power is augmented to 200 cells, thus passing to the distant station a sufficient power to close the relay M at that station and if now the key U be held closed the whole 200 cells is constantly retained by the operator who holds the key U. These

15) Incomplete essay, pages 9, 12, 14, and a damaged page. (4 pages; Edison's hand).


14
effect in the Empire of
the polarized relay
Were the permanent magnets
of the polarized relay
three times greater than
the magnetism produced
by the current from the
battery V. the addition
of the 150 coils would
increase the force with
which the tongue was
thrown from right to
left or left to right
and although the
signals would not
be rendered more
minute when they
would to the ear of
sounder" Observation



15) Incomplete essay, pages 9, 12, 14, and a damaged page. (4 pages; Edison's hand).

used two at one end of the line and two at the other end. (1876)

Two of these relays are of the ordinary character and respond to currents of a certain strength independant of the direction in which they flow, while the other two relays respond only to a change in the direction of the current and independant of its strength,

a magnet of each kind is placed say both ~~by the Washington~~ and ~~at Chicago~~ both Washington and Chicago arranged with extra magnets that the transmission of a double a weak or strong battery current over the wire from only to Washington through the magnets at either end. ~~Between~~ between the magnets placed has no effect upon either, ~~but~~ ~~another~~ ~~extra~~ magnets ~~placed~~ between the ~~other~~ ~~magnets~~ placed ~~between~~ the effect of ~~changes~~ of the battery from ~~to~~ to ~~Chicago~~ ~~flow~~, but the currents acts upon the ordinary relay magnet at ~~the~~ ~~Washington~~ station

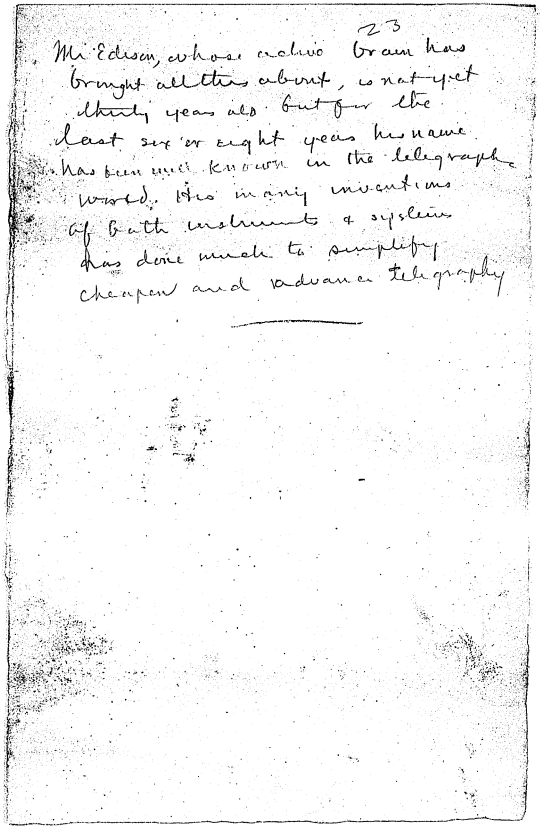
16) Incomplete essay, pages 21-23. May be a continuation of (15). (3 pages; Edison's hand).

Wash 122 1

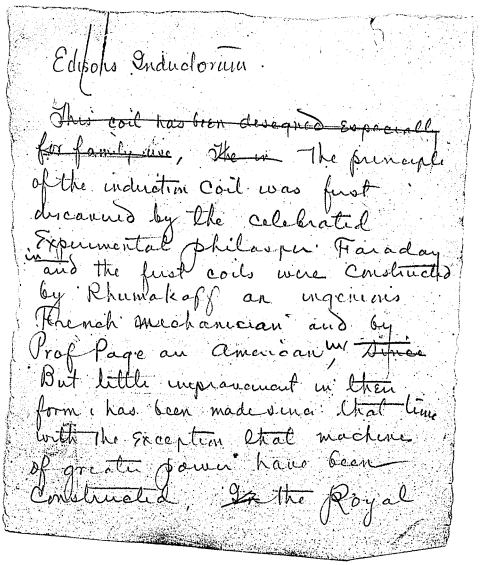
and a signal is transmitted,
If now the duration of the current
be increased at NY the other magnet at Wash
responds and another dial signal is transmitted, ~~at the same time the distant electro-~~
~~to-mag Commutator during~~ & ~~vibrate currents and change the~~
~~direction of flow~~
~~Effect~~

While these two dial signals are being sent from NY to Wash, the latter may in this same manner transmit two dial signals to NY. ~~& although~~ the action of the currents on the line connected is very Complicated yet no two Currents pass each other in opposite directions, at the same time although this is disputed by some Electricians,

16) Incomplete essay, pages 21-23. May be a continuation of (15). (3 pages; Edison's hand).


23
Mr Edison, whose genius brain has
brought all this about, is not yet
thirty years old. But for the
last six or eight years his name
has been well known in the telegraph
world. His many inventions
of both instruments & systems
has done much to simplify
cheapen and advance telegraphy

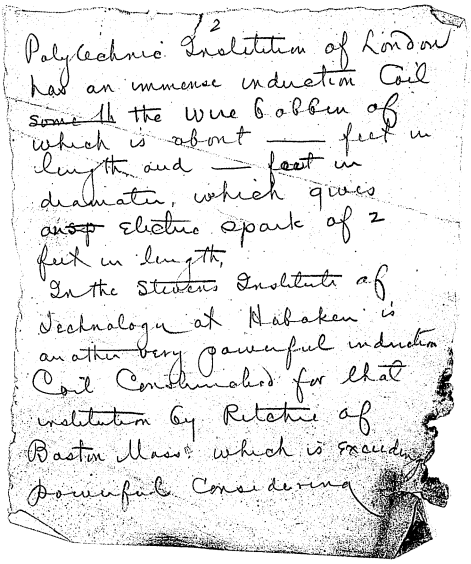
16) Incomplete essay, pages 21-23. May be a continuation of (15). (3 pages; Edison's hand).



Edisons Inductorium.

~~This coil has been designed especially for family use~~, ~~The~~ The principle of the induction Coil was first discovered by the celebrated Experimental philosopher Faraday in and the first coils were Constructed by Rhumkoff an ingenious French mechanician and by Prof Page an American, ~~Since~~ But little improvement in them form has been made since that time with the exception that machines of great power have been Constructed. ~~In~~ the Royal

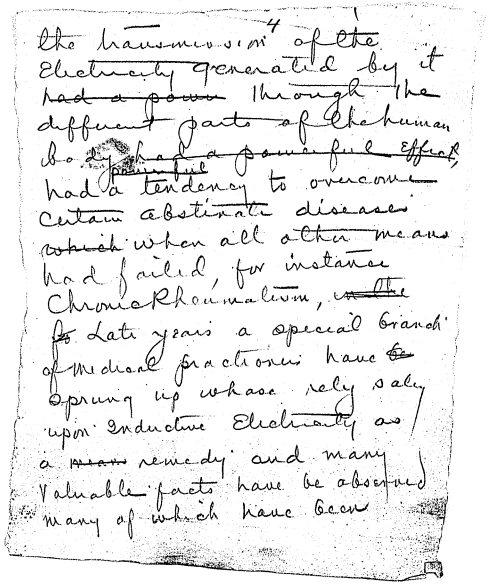
17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).


2
Polytechnic Institution of London
has an immense induction Coil
some 14 the wire 6 ribbon of
which is about ____ feet in
length and ____ feet in
diameter, which gives
an ~~sp~~ electric spark of 2
feet in length.
In the Stevens Institute of
Technology at Hoboken is
another very powerful induction
Coil Constructed for that
institution by Ritchie of
Boston Mass. which is regarded
powerful Considering

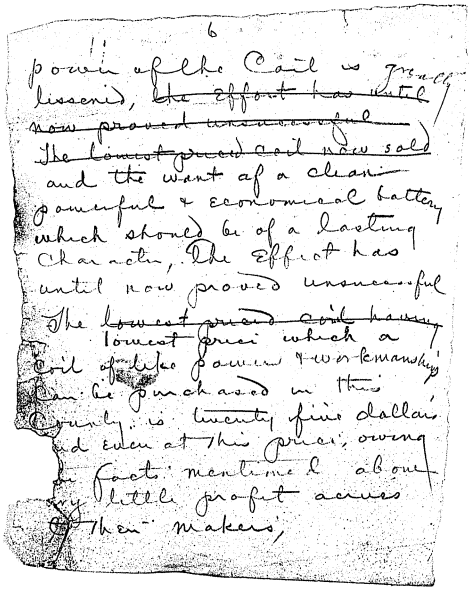
17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).

its rays when compared to
the its English prototype
in the Polytechnic Induction
Prof Morton has succeeding in
making the spark
penetrate through a solid
block of glass 4 inches
square the course
of the spark being beautifully
shown by the fracture in the
line of the path, The induction
Coil in the hands of the hands
of the Scientist has proved
a powerful instrument of
investigation, = But it was
not long after the introduction
of the induction Coil before
it was discovered that

17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).


the transmission of the
Electricity generated by it
had a power through the
different parts of the human
body had a powerful Effect
had a tendency to overcome
Certain obstinate diseases
which when all other means
had failed, for instance
Chronic Rheumatism, In the
last years a special branch
of Medical practioners have
sprung up whose rely soly
upon Inductive Electricity as
a means remedy and many
valuable facts have be absorbed
many of which have been

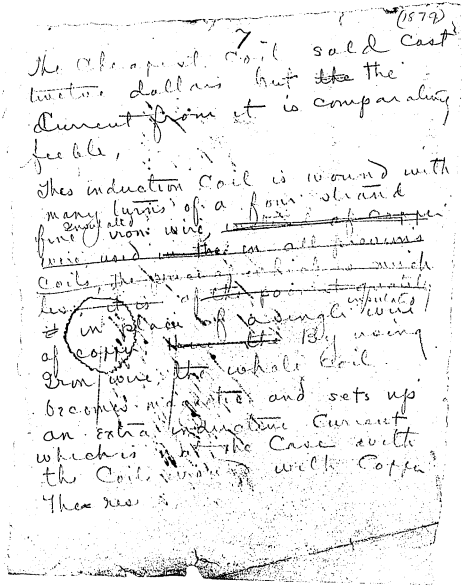
17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).



6

power of the Coil as [illegible] lissened, ~~the effort has until now proved unsuccessful~~ ~~The lowest priced coil now sold~~ and the want of a clean powerful & economical battery which should be of a lasting Character, The Effort has until now proved unsuccessful ~~The lowest priced coil having~~ lowest price which a Coil of like power & workmanship can be purchased in this Country is twenty five dollars and even at this price, owing to facts mentioned above little profit accrues to the makers,

17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).


(1879)

7

The (illegible) coil sold Cost twelve dollars but the Current from it is comparatively feeble,

Thes induction Coil is wound with many (1500) layers of a four strand fine wire wire ~~of copper wire used in the~~ on all previous Coils the greatest ~~number~~ of ~~the~~ possible ~~turns~~ of ~~wire~~ is obtained by winding ~~of copper~~ ~~the~~ By using ~~from wire~~ the whole Coil ~~Bracket~~ and sets up an extra ~~induction~~ Current which is ~~in~~ the Cave with the Coil ~~wound~~ with Copper Thes res

17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).

8

The coils are then boiled for several hours in specially prepared paraffine to thoroughly insulate each convolution from its neighbor and prevent loss of power,

The workmanship [illegible] is fully equal to that given by the best philosophical instrument makers, and unlike that of most cheap coils now sold, which are made without regard to beauty or lasting qualities, The battery accompanying this coil is a Bunsen Bichromate of potash battery complete, and the same as used by the Telegraph Co

 "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).

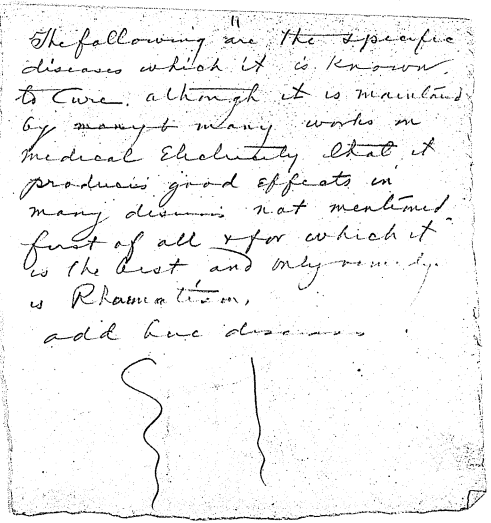
with the exception that the zinc of this battery is chemically pure and will last twice as long as the ordinary zinc unnecessarily used. Besides giving a volume of Current and gas no hydrogen,

It is the most powerful battery known and it may be used for other purposes than in Connection with the Coil - When connected to a small Electro magnet it will cause it to sustain several pounds of iron in Contact with the Core. Among the uses to which the battery can be put to may be mentioned, Electro plating with Silver and Copper etc,

17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).

working ~~the~~ Magnet telegraph instrument, for short lines of telegraph, for ringing Electric bells, for decomposing water into Oxygen & Hydrogen gas, twenty Cells will produce an intense Electric Light between ~~Lamp pencil points~~ Carbon points, 3 three Cells will heat fine platina wire red hot = and innumerable other uses, The power of the Coil may be greatly increased beyond human endurance by adding two to four cells instead of one, although it is seldom that a person can stand one half of the Current generated from the six cells

17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).


The following are the specific diseases which it is known to cure, although it is maintained by many & many works on Medical Electricity that it produces good effects in many diseases not mentioned first of all & for which it is the best and only remedy is Rheumatism, add here diseases

17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).

Note

By pulling the regulating rod just out of the end of the Coil a knife may be manipulated by pressing it on the ten part of the rod & passing it back & forward 1/2 dozen times -

Note

It may be made to act as a burglar alarm by attaching two pieces of tin one the window sill and Connecting the halfs of door knobs and allowing the Coil to vibrate all Night -

or by Connecting a wire so that when a window is raised or a door opened it will close Bally Ckt & the handles being Connected to a Cat, she will give an unearthly & diabolical Yell & wake all up.

Patent applied for

17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).

If a current be sent in the Course of the nerves
Connected with the vision or Locate there annalise
Strongly Excited - a flash light, a noise or metallic taste
is at once perceived. Wilson Philp
Medlencei absence - p 10.

The Induction Coil has lately come into general favor
& is used for a varied purpose as a medical aid, a
means of scientific research & an amusing
toy for some and an unfailing fount of
Amusement. Chem news - to

18) "If a current be sent . . ." (1 page; Edison's hand).

Telegraph Journal

England

To be rewritten

On the Effect of Self Induction on decreasing the speed of polarized relays

The number of vibrations which can be obtained from a polarized magnet of a given length is controlled by the Ohmic Resistance of the circuit in which it is inserted, supposing there is no other interfering cause such as static induction etc. The greater the resistance of the circuit the greater will be the number of vibrations of lever per minute, supposing of course that there is sufficient EMF in the circuit to actuate the magnet. In other words if a polarized relay be inserted in a closed circuit of 200 ohms in which reversals are sent from a battery of sufficient force that the magnet of the relay will attract its tongue with a force of say 100, the number of vibrations will not be so great as when the relay is on 2000 ohms and the attraction force remaining the same, in fact if the resistance of the circuit is increased to 10000 ohms with an increase of battery power sufficiently to give the magnet an attractive power of 20 only the speed number of vibrations will be several times greater than on 200 ohms resistance & a battery power 5 times greater

19) "On the Effect of Self Induction . . ." (4 pages; Edison's hand).

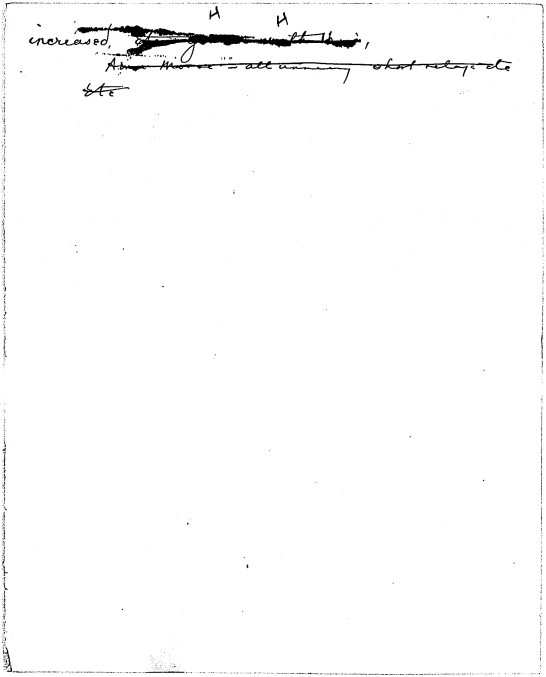
The reason for this is that when the relay magnet is inserted on a low resistance the electromotive force of the induction discharge is great owing to the low resistance of the circuit on which it is generated, this discharge which follows after one reversal in the same direction as that reversal must be neutralized by the next ~~revers~~ current which is in a contrary direction, this of course lessens the number of vibrations per minute. If now we increase the resistance of the circuit to 2000 ohms or 10 times greater than in the first instance, and increase the battery power so that there shall be the same EMF in the circuit as before the discharge from the relay is 10 less while the attraction power of the magnet is the same, as in this instance the flow of the discharge is checked to the extent of the extra resistance of the Circuit in which it can flow or in other words the induction discharge will be 9 times less from a relay on 2000 ohms with the same EMF actuating it as upon 200 ohms If we increase the resistance to 10,000. with no leakage to forms routes or

19) "On the Effect of Self Induction . . ." (4 pages; Edison's hand).

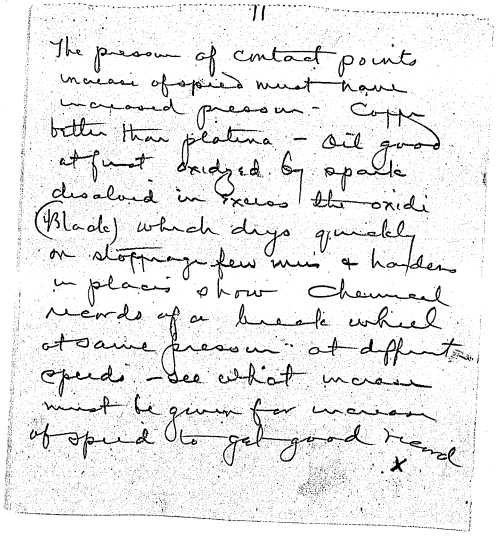
derived circuits where the discharge from the relay Can flow the discharge is so much reduced that it scarcely impedes the vibration of the tongue ~~Coil of the EMF~~ and the limit of speed may be obtained as far as regards the inductive currents from the relay.

From these facts it is obvious ~~that were it not for the static induction of the line, it would~~ be the greatest speed would be obtained from a polarized relay when several thousand ohms were inserted between the line and the relay as the resistance on the self discharging circuit formed of the wire & the combined leakage would be so great that it would have scarcely any effect upon it, when the leakage was very great. the discharge circuit which is the earth plate on one side & the leakage on the other is of so low a resistance that the speed of vibration is enormously decreased whereas by inserting a resistance between the relay & line the speed will in the same proportion be

19) "On the Effect of Self Induction . . ." (4 pages; Edison's hand).

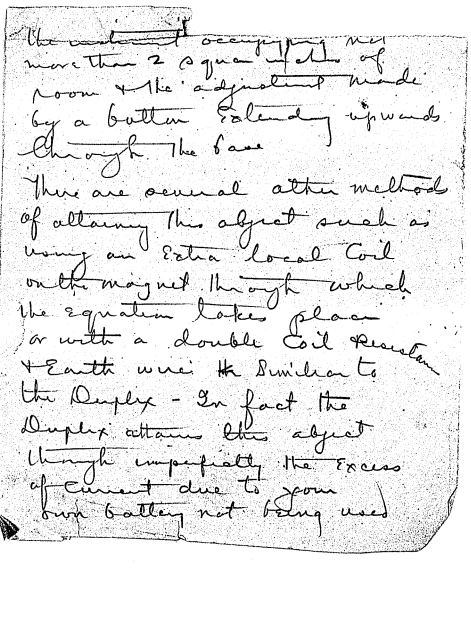


19) "On the Effect of Self Induction . . ." (4 pages; Edison's hand).

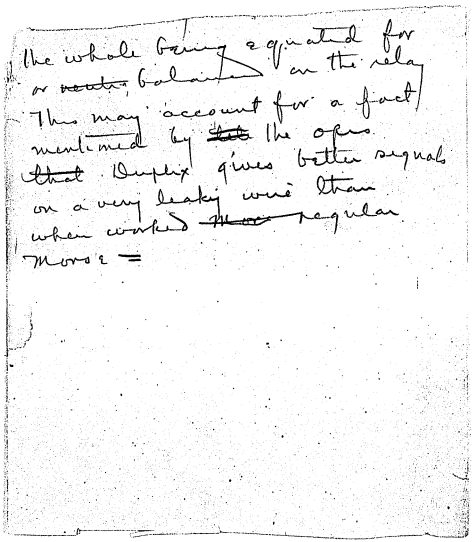

11

The pressure of contact points increase of speed must have increased pressure - Copper better than platina - Oil good at first oxidized by sparks dissolved in excess the oxidi (Blade) which dries quickly on stoppage few min & hardens in places show Chemical records of a break wheel at same pressure at different speeds - see what increase must be given for increase of speed to get good record

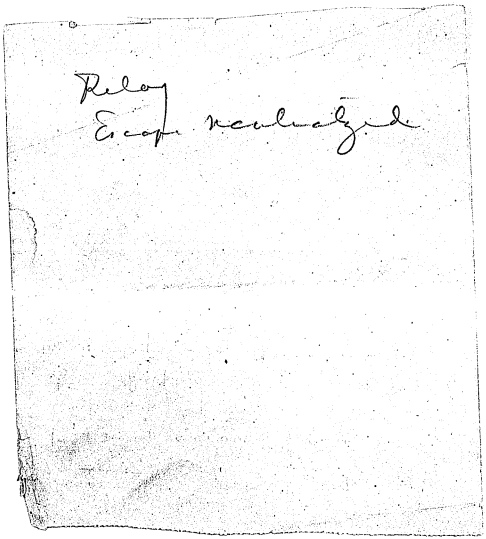
20) Three pages of fragments from essays in Edison's hand.



20) Three pages of fragments from essays in Edison's hand.


The whole being equated for
or neutral, balance on the relay
This may account for a fact
mentioned by [illegible] the opera-
that Duplex gives better signals
on a very leaky wire than
when worked [illegible] regular
Morse =

20) Three pages of fragments from essays in Edison's hand.


Relay
Escape neutralizer

1875. General (NS-75-001)

This folder contains two documents. The first is by Charles Batchelor and is a list of possible inventions labeled "Wanted May 31 1875." A similar list can be found on page 2 of Cat. 1214, Account Series. Cost accounts for experiments related to these lists can be found on pages 60-126 of Cat. 1214.

The second document consists of 16 pages of notes and drawings by Edison relating to experiments on the electromotograph, some of which may concern the use of that device for telegraphy.

Wanted May 21 1870

4. 1 A Method of making Malleable iron out of cast iron

2 Making Cast iron as hard as steel & & have some of the same properties

3 A Method of making 'sawdust' soluble & form a cheap substitute for Ebony Hard rubber or Celluloid.

4 A cheap intense green equal to Aniline green without Iodine or Arsenic.

5 An Electron agent which does not require wire

6 The formation of organic substances for the decomposition of water under certain influences.

7 A Kerosene or other oil lamp which burns without Chimney & gives a bright light

8 A new Engraving process

9 A Galvanic Battery of equal constancy & Daniels but with an electromotive force equal or nearly equal to Grove.

10 A substance which will not pass or pass but little P. current & all of a N current

11 A new force for telegraphic communication

12 Make soluble peroxidized paper with less acid than the Cellulose Co.

13 A cheap process for the extraction of low grade ores, decomposed and like cuttas Cass Ag. & H_2S Ag. ores.

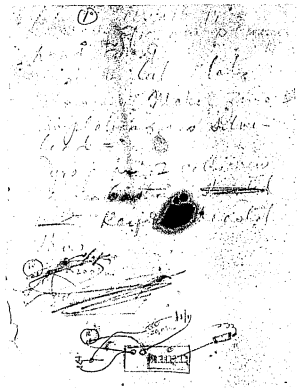
14 A Platina solution cheap & as delicate as Iodide of Potassium without drawbacks

15 A Detector for Gold & Silver at a distance.

16 A Polarized Electromotograph.

17 A Londuplex Telegraph.

4	18	A copying press that will take 100 copies at a time.		
	19	A cheap process of printing news.		
	20			
4				

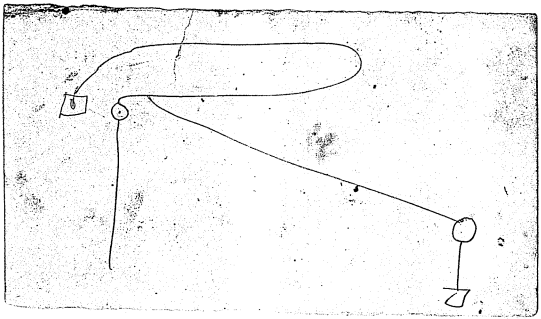


(When all current passed through the pipe paper slipped in all metals with Hydrogen by decreasing Resistance of the R. except a small friction when through probably

2 Discovery

1/4 all the metals Except Tin showed an increase in friction or passing the current but tin still showed the slip. can but by still further Churning the Current into it so that finally passed through Tin stopped slipping and increased into friction

Another value to Churning was that when all metals except tin had an increased friction on the moment of closing the normal friction was increased say 10 degrees on opening the friction was increased to 30 deg but almost instantly subsiding the instant the Current was interrupted thus friction was fearful string.

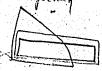


3 discovery

This friction may be represented like

Normal friction ——
Increased friction ——
Friction on opening —.—

or



I then tried permanganate a solution of Caoutchoucine but on account of small Current used it didn't show anything not being near a Conductor as pyro

I then put somevalt Nail in with the Caoutchouc when I found that this strip for Excellent Library the

4 discovery

Pyro - and gave an unexpected phenomenon,

No increase of friction Conductivity noticed on Closing but all metals after the Current was very much weakened gave no results except zinc and this was very marked after all action even tho had ceased - and the slip was noticeable

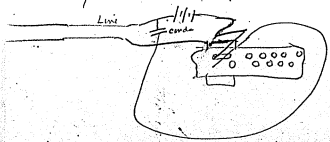
This paper is the most valuable yet found & shaved between an agate drum

5 discovery
Have found that Silver
will even Gilt Chain zinc
on any low current
though on an exceedingly
fine Count zinc may
be better, Aluminum
appears well on a fine
Count but slips with
slowly momentary open
friction, Tried perfectly
pure (10) wood pape
and trapped Gilt
Chain Common Boot tin
perhaps thinde Wood
pap will be better

6 discovery
I give zinc the preference
of Silver with a low
Count on Wood pap
thinde,
Platina is exceedingly bad
gives very little with fine
Count on thin middling
Silver slips [illegible]
but O very slightly
perhaps some adh- do but
not natural OC =
We wet 2 rolls of
Bantino K. + Nacl
+ tried on EMF
found that with sending

7 discovery

Shunt 1300 ohms of the Condenser that we could by shunting E.M.U. repeat slowly so it could be read though very jaggie without shunt nothing, with this arrangement words could be read but they were somewhat jaggie. They is something in it



This weakens the first part of a dash +

8 discovery

leaves end full strength as the first portion of Battery Current has two routes, the line + Condenser until Condenser is charged full Current dont go on line. The secondary coil pair short circuits the Condenser through the discharging coil + prevents its Charge going on the line,

With the paper tape highest speed straight 21-24 letters that was ever obtained about 1200 words a minute =

9.. [inf new dia]

With the new lever the Escapement we could get higher speeds but the separating Contact was very imperfect for some reason, we had no spring of platina point yet & so under the impression that the old right-angle vibrator would do great separating without a spring. We intend if getting or a spring or new lever to test Contact,

The lever used with the Polarity paper

10 discovery

was the old style =

after getting 12000 words per minute obtained (10) 15000 ohms to Sokutsu Emily with 100 & also with 1000 ohms but could get nothing that was readable at 75-1 words minute. This showed that some powerful secondary force action or alternance is circulating within the closed circuit which throws whole thing out of adjustment

11 Discovery

We have found that the thick wood pulp used for perforating answer cards admirably for Emily two more cuts & cuts finding than rag paper used for learning =

We now 3:50 am are going to make various Emily solutions for test on hand Emily to endeavor to obtain a paper free from the secondary phenomenon

12 Discovery

Sulphocyanide increases fraction on H very powerful when not shunted =

Uric not shunted on N increases fraction when shunted it "slips" best on zinc

Bichromate K on H full slips slightly on N full fraction great vibrating shunted fraction best on Cu brass, shunted slower also fracking zinc on Silver

Sulphocyanide K working on any except slight fraction. Thumb on Silver on H

13 Dec

Jodine (Iodide) nothing

Grape sugar fructum great on ☉ = platina + silver best,

Borax, Iodine incr on ☉. platina + silver nothing on ☿,

[illegible] Iodine [illegible] on Platina

Carbonate Lime very valuable

14 Dec

Hypposulphite Soda nothing on ☉ slight on ☿ good Gold Plat + Silver Cadmium perhaps better - Iron [illegible] Corrosive

Iodine 2 cells, 75 ohms main Key and Emly (hand stop) shunted with or without, 200 ohms

Cocoa [illegible] Iodine nothing on ☉

Hypposulphite Soda + Iodine Cadmium Fe mixed nothing on ☉ Fructum increased on ☿ but nothing valuable when shunted

15 Dec 09

Hypo. Na – Sesquich + Nacl makes bleed-mark on platina with platina might be fault up = no grad in Emly Tartaric a + Grape Sug dont impress mark =

Sul Zinc slight slip on ⊖ function considerable on ⊕.

Urio. a slight (very) increase function on ⊖.

Ordinary pyro act one way & then another inside 2 mins from same roll – ~~many~~ phenomena must be on platina absorbing gum =

1875. Telegraph (NS-75-002)

Tracings follow other notes and drawings.

July 13 1875

Domestic Telegraph
Hotel annunciator
Experiments

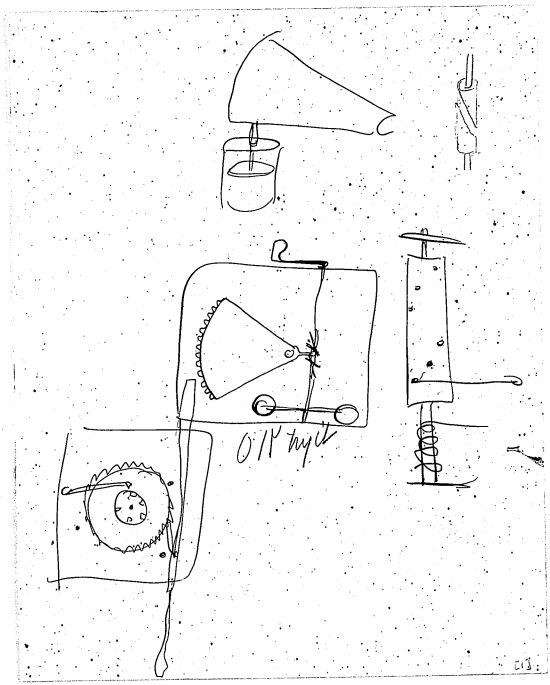
To be tried

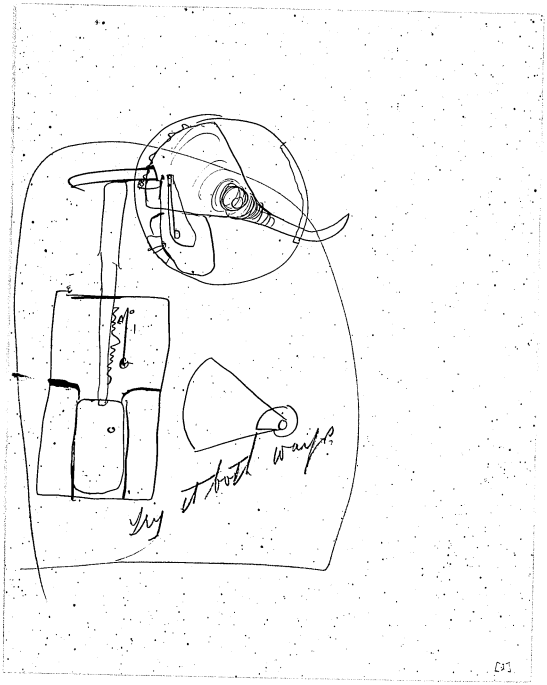
$$\begin{array}{r}130\\20\\\hline 150\end{array}$$

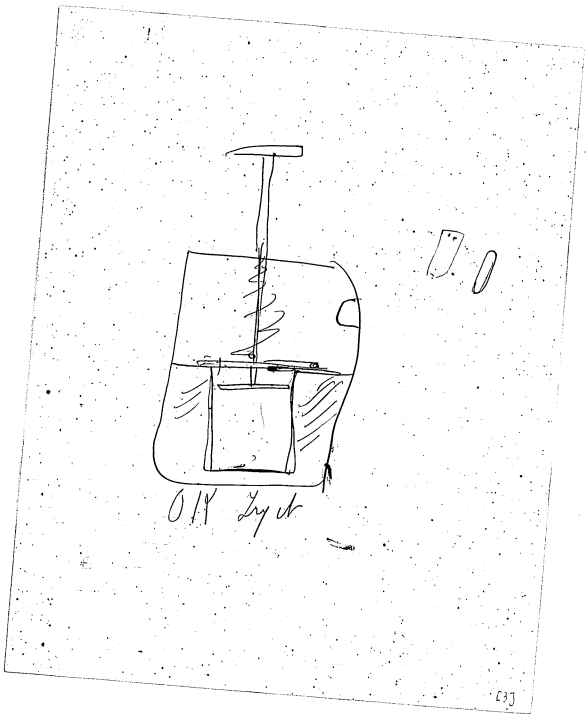
1500

1500 Boxes at 2 3000
1 Recorder — 200
1 Relay — 16.

Used in law suit; Edison vs. A&P & Domestic Telg. Co Apr 1878

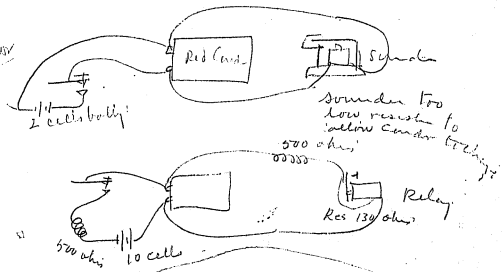

Oil tight




0.1 Zyk

Nov 2 1877 875

Edison
Glasgow Patent Office



apparently the Condenser discharges a reverse charge through relay & kills the residual magnetism

With or without reasons, putting on Condenser ~~across~~ ~~Relay~~ ~~discharge~~ ~~to water~~ makes relay work sharp & an adjustment that the relay should ~~not~~ ~~absorb~~ absorb the (1 c) about 2 sec after opening or ordinary breakment with key / Key or more for relay discharge

Nov 21 1875

C Cooper electric in Assembly Building X

Sounder

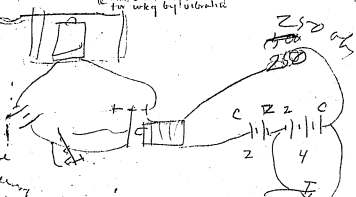
dots for apart keeps sounder closed, the longer the dots & longer the spaces the greater the force of the electric current

Chappe's telegraph

W H Edwards

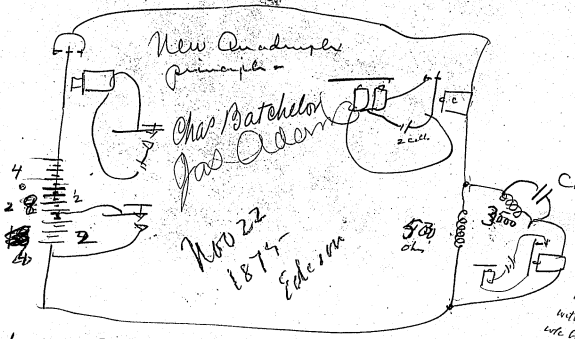
Chappe's telegraph X

weight at x dent
wire any wire =
but on clamp
Relay Key the grips
makes the down stroke
when under pressure
the other jumps makes
the back stroke

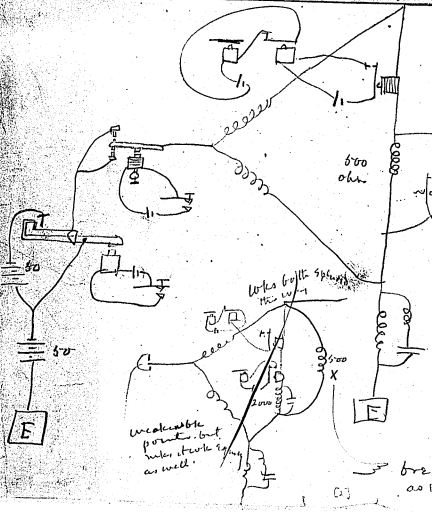


the receiving Sounder perfect & assembled & without the necessity of the sounder lever down the backpoint this dropped with the pulsing & heavy in the Sounder X

I think that if the back point relay C had a second contact with a local + R coil so as to by-shunt this permanent current it might work both through it might increase a current + make it more



With 1000 ohms in Condenser R not very good but better than 500 ohms or non used in Condenser used, but when the made 3800, the dead open relay works perfectly splendid and the back point relay works better than when reversed Currents are used altogether the arrangement is a grand success



Nov 22 1875

Faraday
Charpentier

Quadruplex

Relay

Third a front point relay with total breaks required by shunting relay also by shunting a wire of each by back point breaks show loo plans & must use break point relay

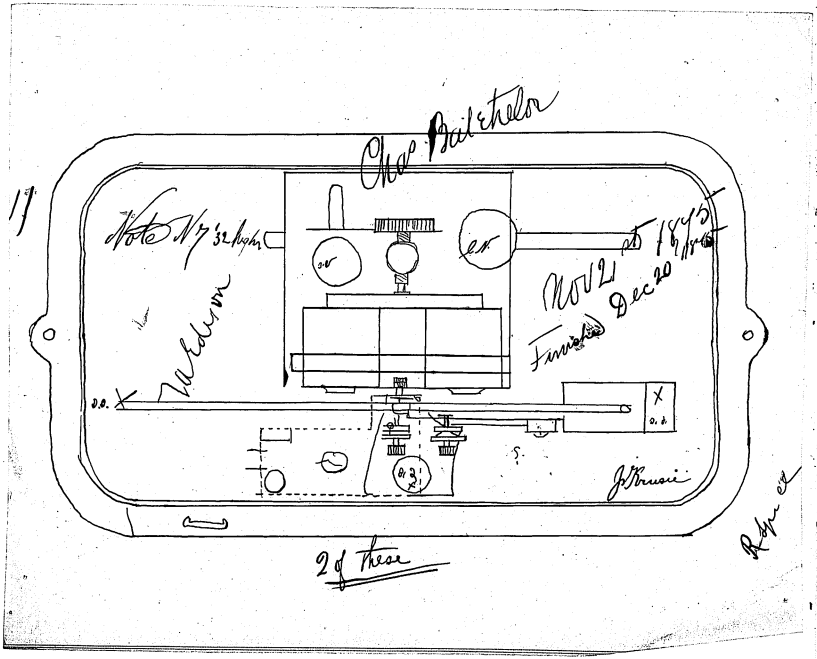
at C

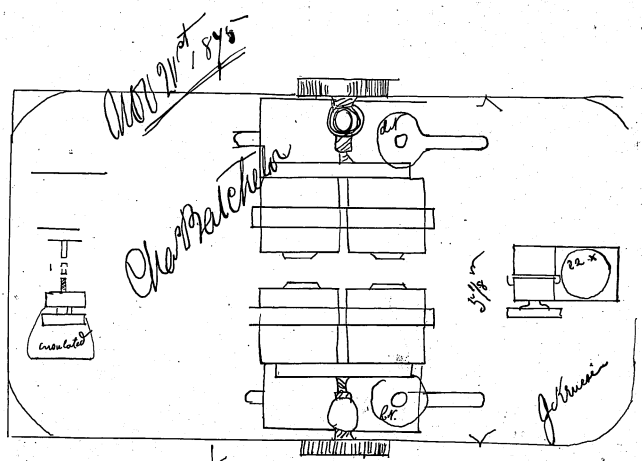
OR the Wheatstone pole beat

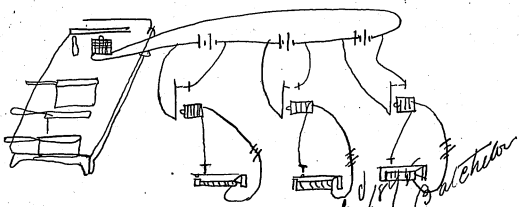
2
4

3
1
6

This works perfectly, the arrangement of a relay & is to adjusted that when a current comes in a signal line, relay b opens & closes "Each" forwards & backwards of course "a" and "c" are drawn alike on drawing which is beautiful, The total breakage does not affect C as it is necessary, Shunting is worked & Carter works it wrong

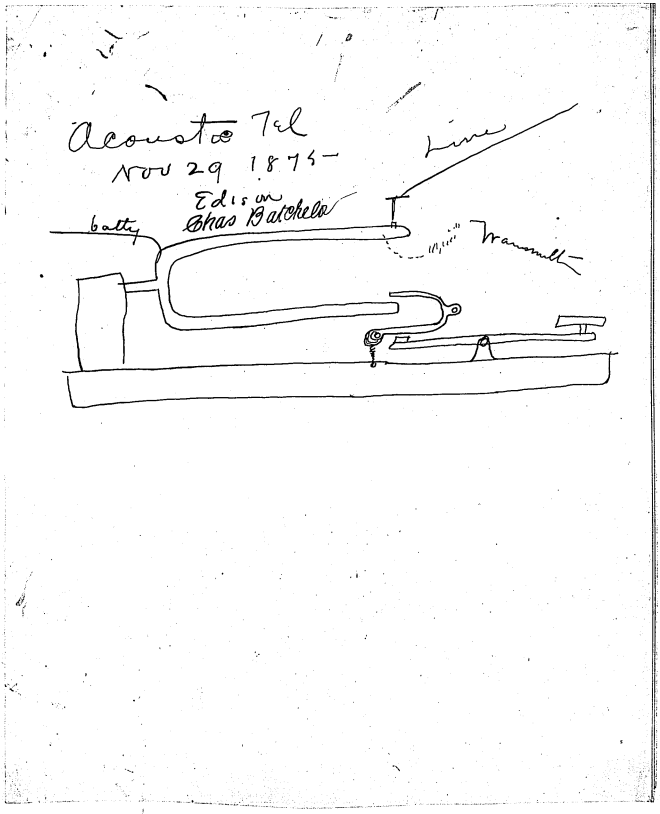

Chas Batchelor
11
Note No 32 high
Tailstock
No 2 at 18 9/16
Finished Dec 20
X
0.4
J. Brown
2 of these

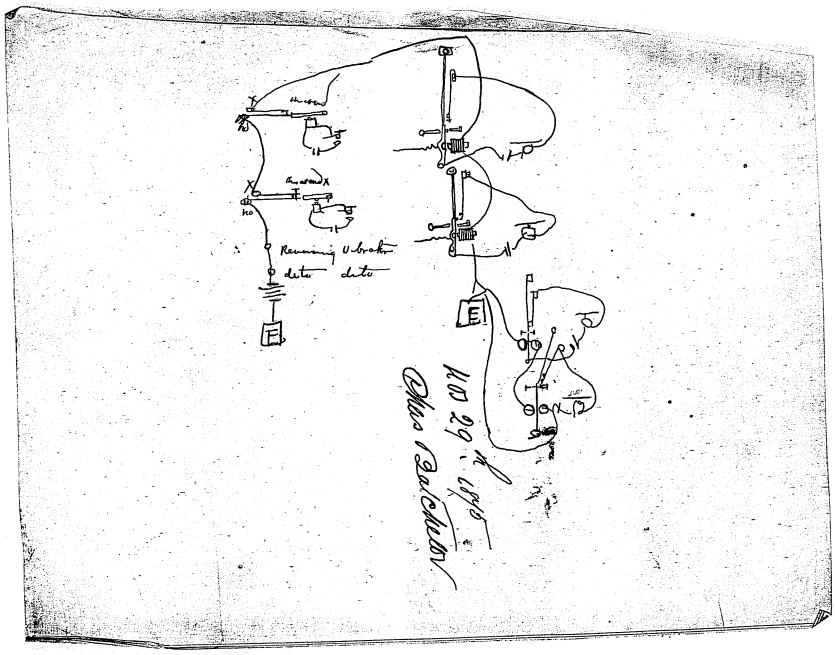

Insulated
5/8"
22"



Try this Gov 9th Chas Patchen

Exhibit D
Case 116


Acoustic Tel
Nov 29 1875
Edison
Chas Batchelor
batty
Line
Mammell

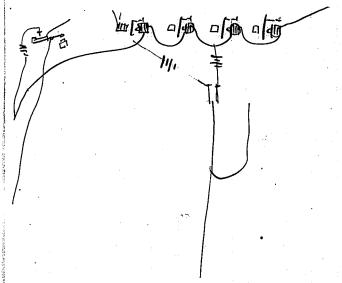


Nov 29th 1875
Chas Batchelor

1876. General (NS-76-001)

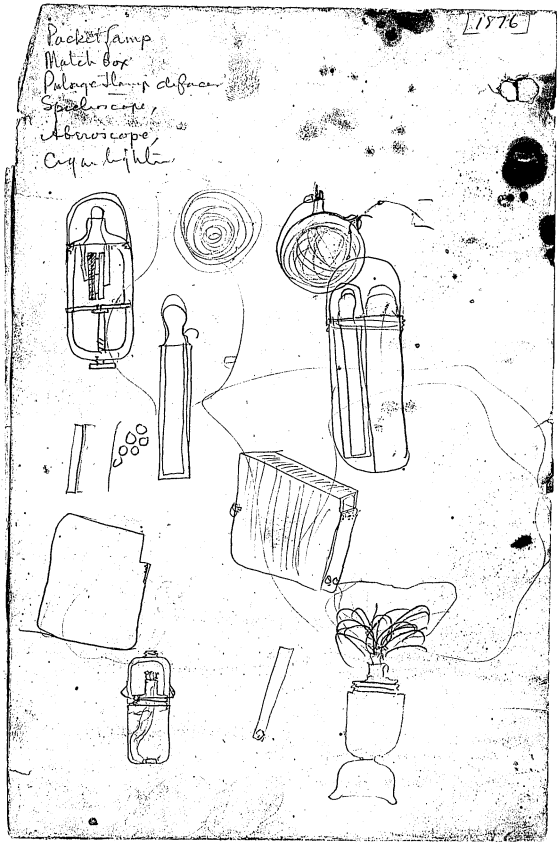
July 15 1876

T A Edison



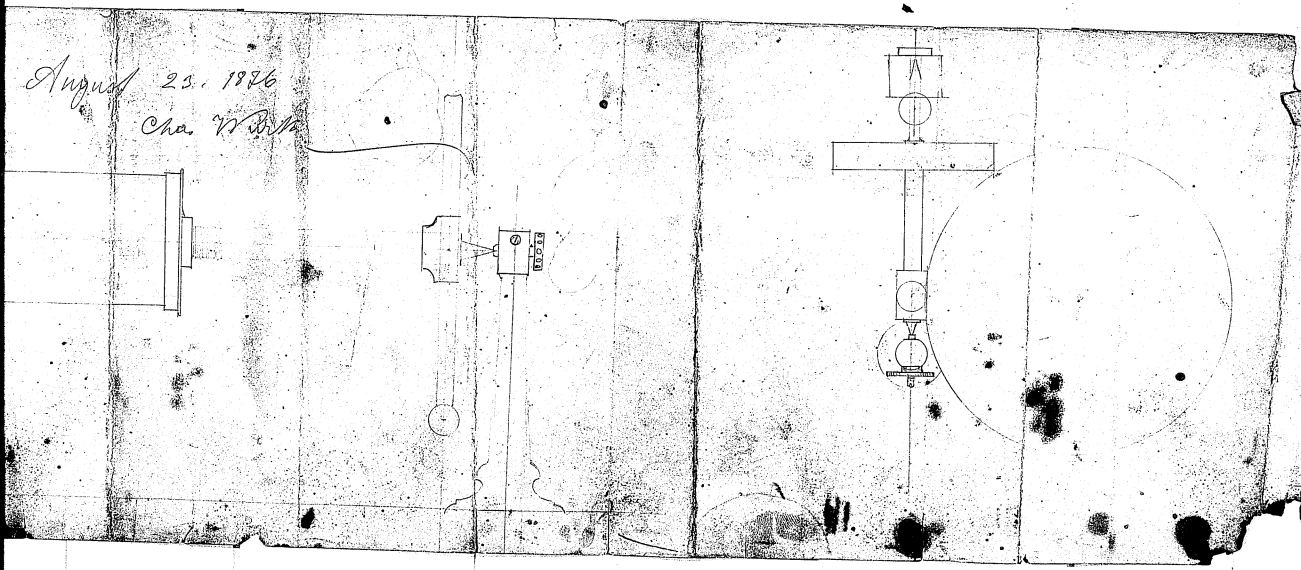
1876

Pocket lamp
Match Box
Palagentlamp of Parisian
Speculascope,
Laryngoscope,
Cigar lighter

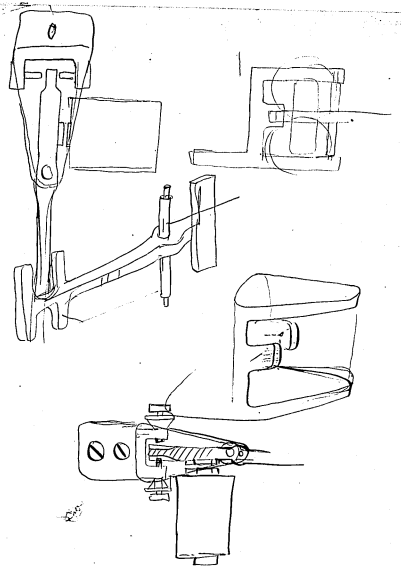


[CONTINUED ON THE NEXT FRAME]

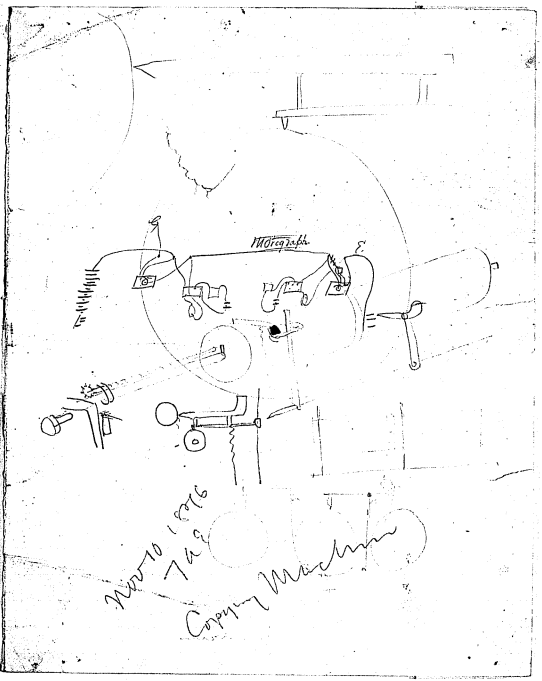
August 23. 1876
Chas. Wirtz



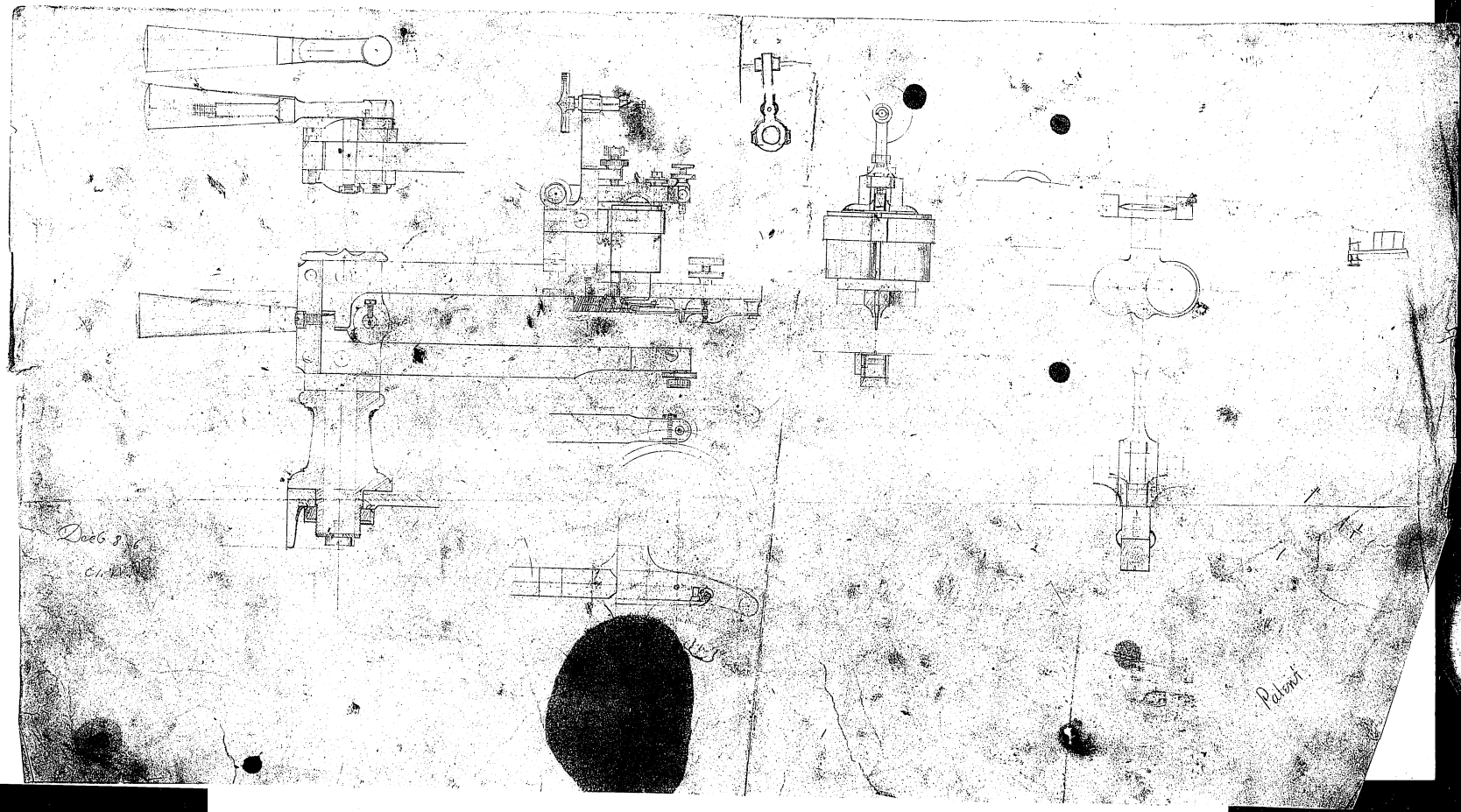
[CONTINUED FROM THE PRECEDING FRAME]



Oct 6th 1876

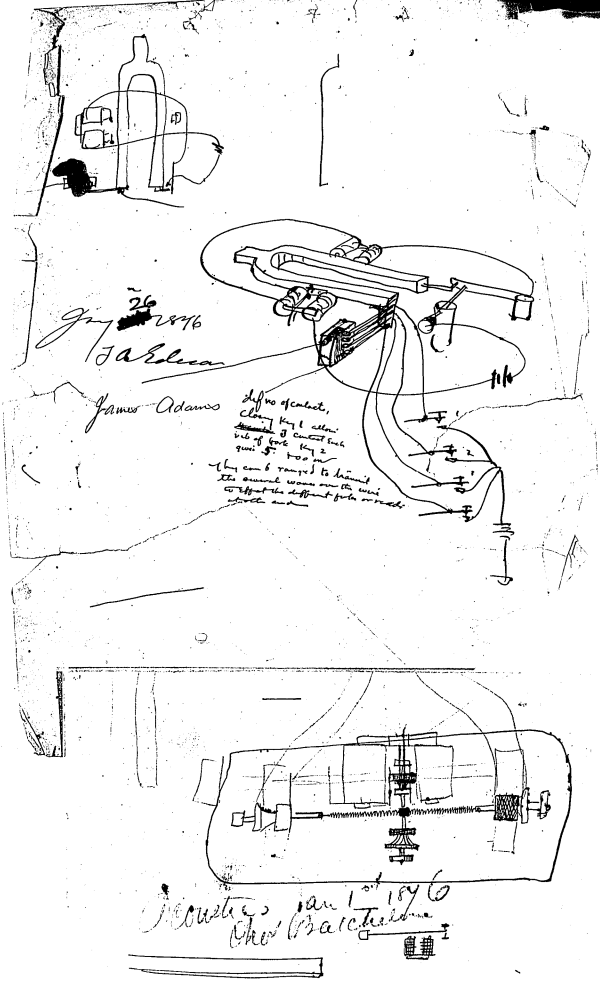


Nov 10, 1896
7 & 8
Copying Machine


Patent

1876. Telegraph (NS-76-002)

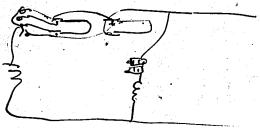
Tracings follow other notes and drawings.


26
1876
James Adams
No 1 of contact,
No 2 of contact,
No 3 of contact,
No 4 of contact,
No 5 of contact,
No 6 of contact,
No 7 of contact,
No 8 of contact,
No 9 of contact,
No 10 of contact,
No

Receive without any battery

also do & reverse at one end of a Quadruplex and receive with a polarized relay

test the line strength when with battery used on Campfer Shunt to Earth with a magnet



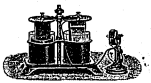
Try the key loop in place of the Washington loop

Improving my battery

July 10 1874

HAR.

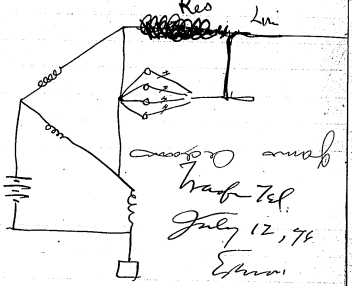
Edison's Electrical Pen & Duplicating Press Co.

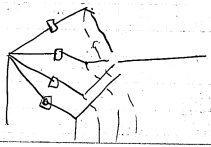


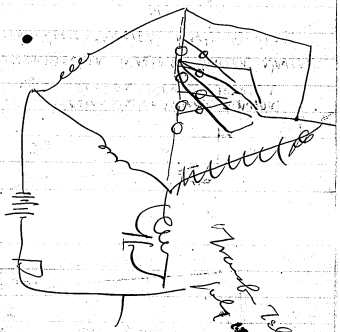
41 DEY STREET,
NEW YORK.
MANUFACTORY:
MENLO PARK, N. J.

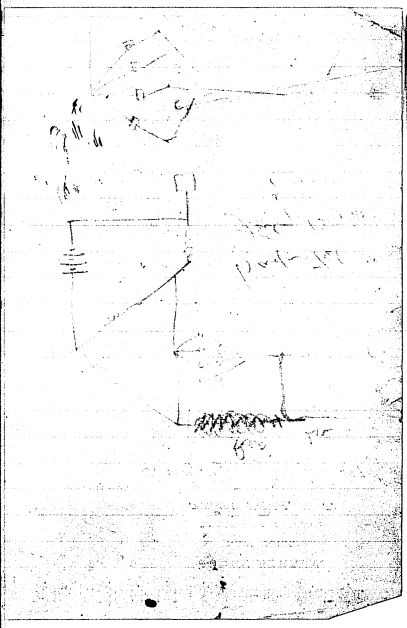
P. O. Box 5207.

New York, ... 187

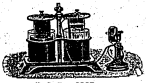








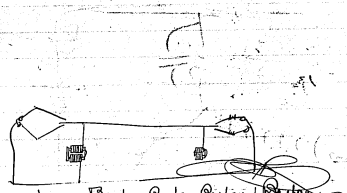
Edison's Electrical Pen & Duplicating Press Co.



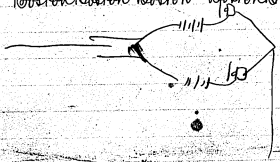
41 DEY STREET,
NEW YORK.
MANUFACTORY:
MENLO PARK. N. J.

P. O. Box 3207.

New York, _____ 187



Boston Boston Boston Boston
Boston Boston Boston Boston
Boston Boston Boston Boston Boston
Boston Boston Boston Boston Boston

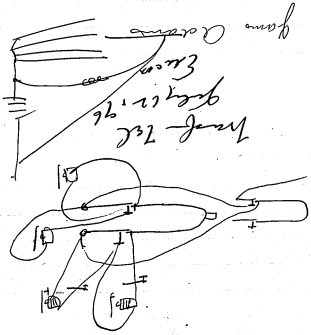


Edison's Electrical Pen & Duplicating Press Co.

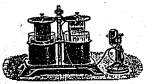
41 DEY STREET,
NEW YORK.
MANUFACTORY:
MENLO PARK, N. J.

P. O. Box 3207.

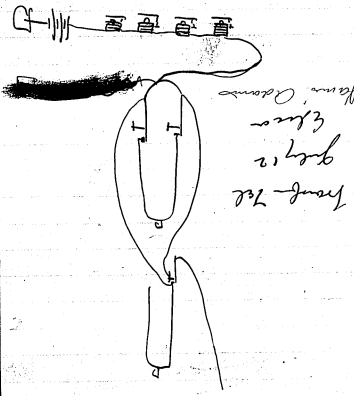
New York, ... 187

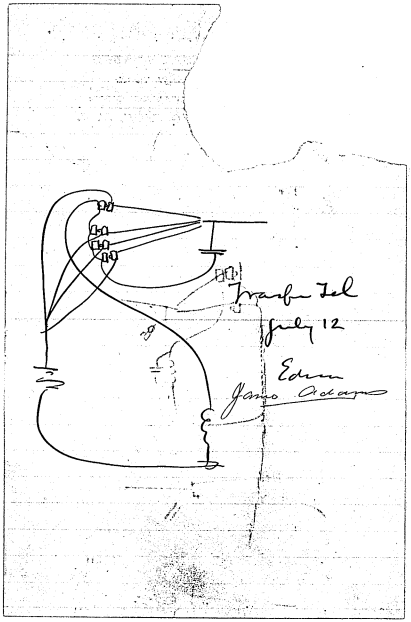


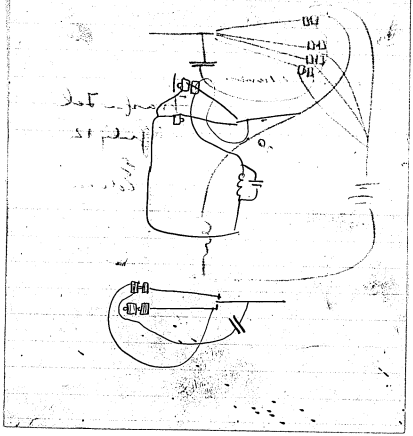
Edison's Electrical Pen & Duplicating Press Co.

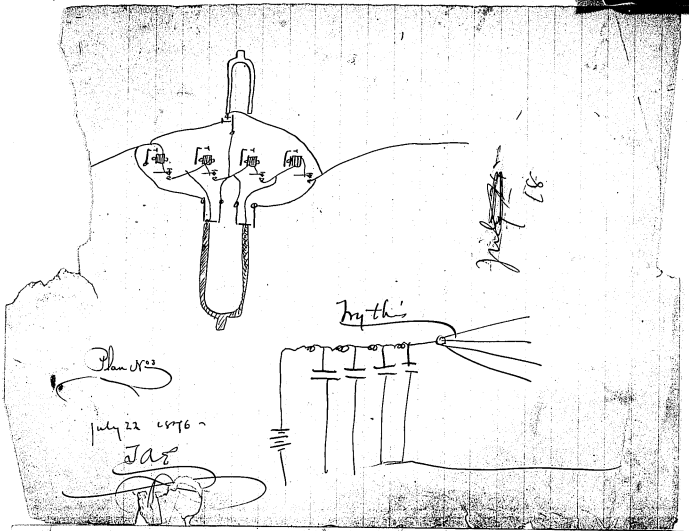


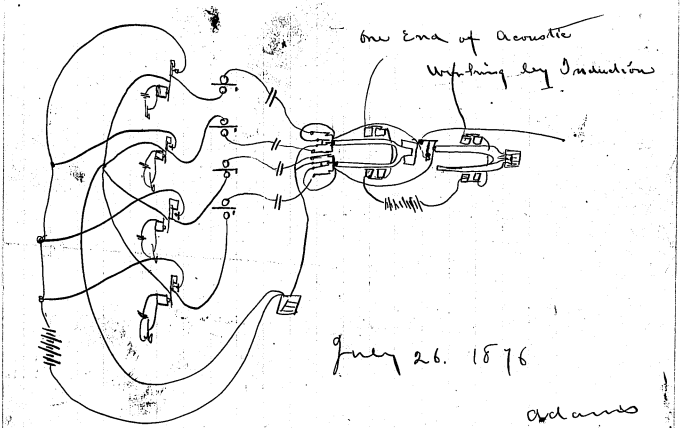
41 DEY STREET,
NEW YORK.
MANUFACTORY:
MENLO PARK, N. J.
P. O. Box 3207.
New York, ... 187




Transfer Tel
July 12
Edison
James Adcock

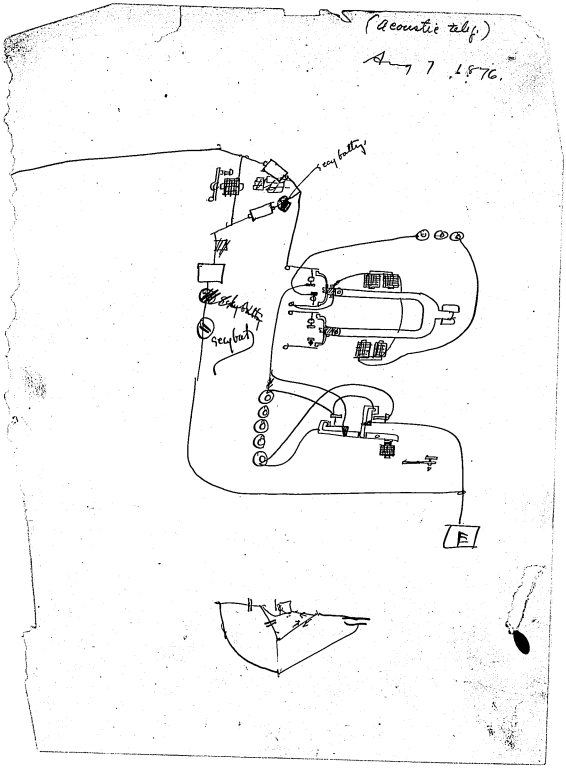


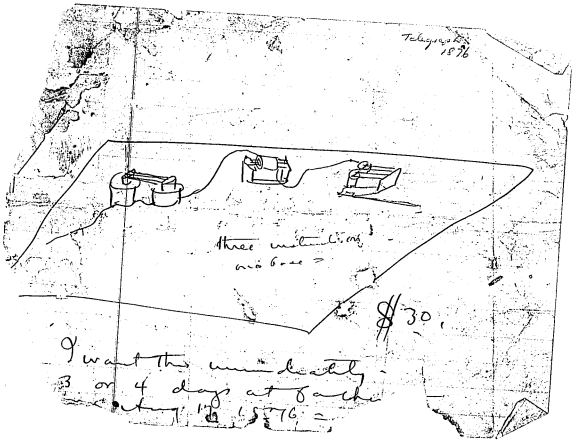

Plan No 2
July 22 1876
JAP

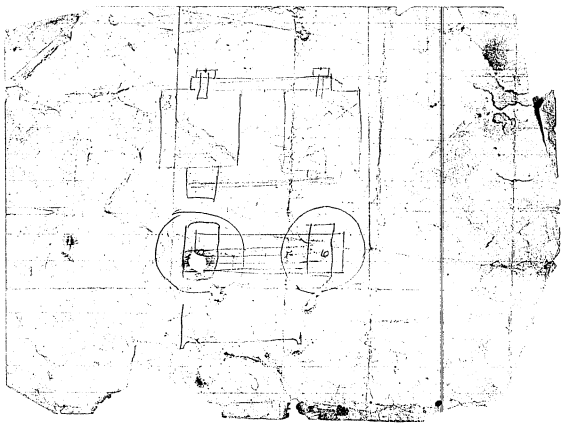

One End of Acoustic
July 26. 1876

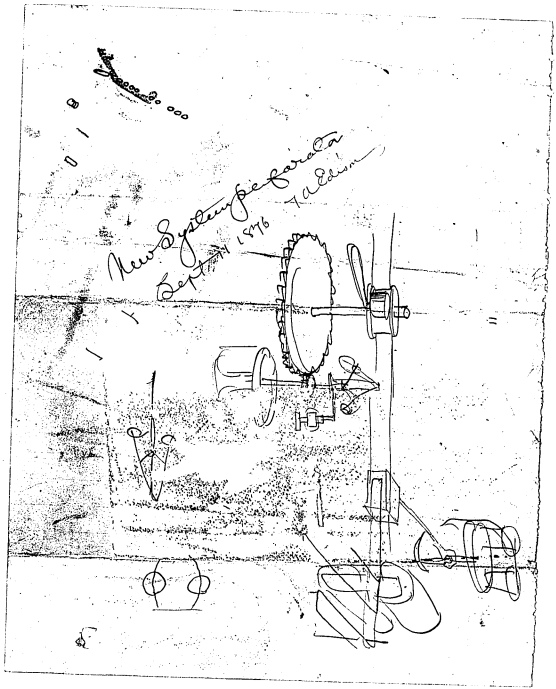
(acoustic telg.)

Aug 7, 1876.




Telegraph
1876
Three watches
and 6 ...
$30.
I want this watch
3 or 4 days at each
1876



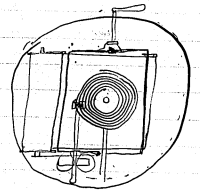

New System Perfected
T. A. Edison
Sept 1878

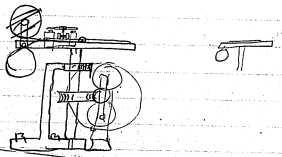
T. A. EDISON, NEWARK, N. J.

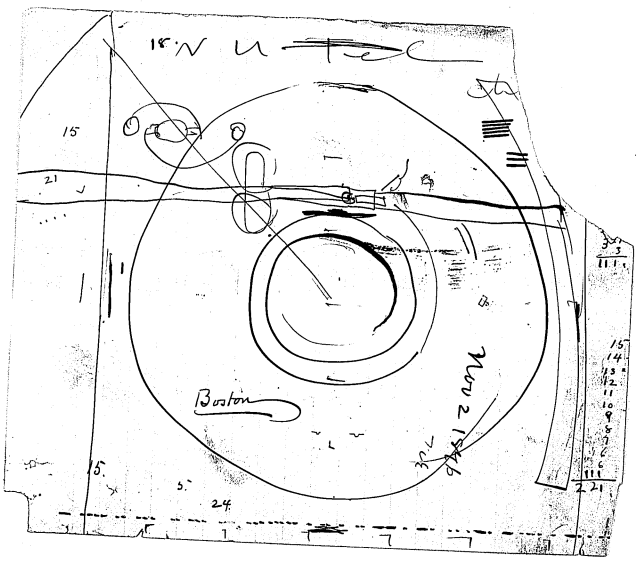
10 & 12 Ward St., 18

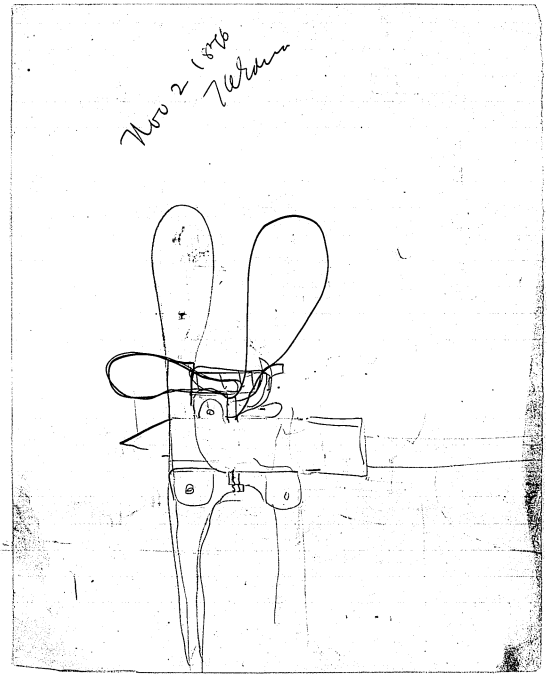
Nov 2 1876

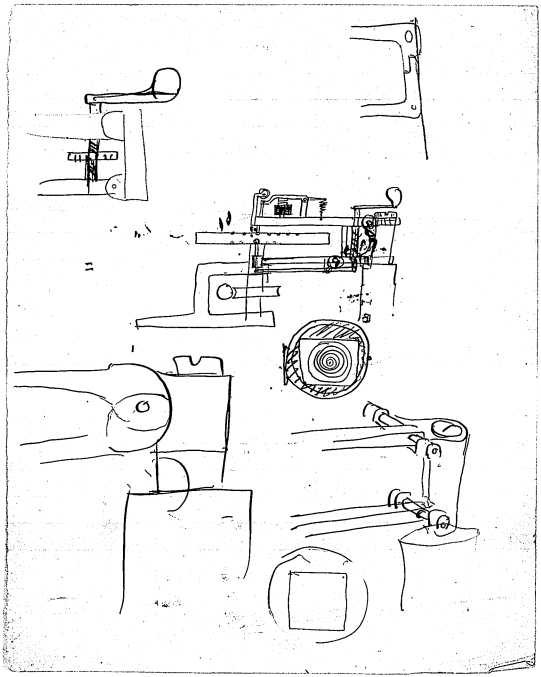
Acoustic Experiment

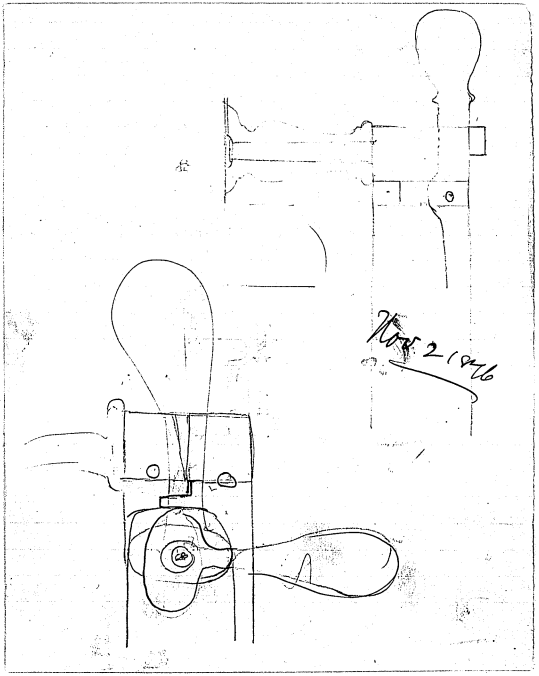


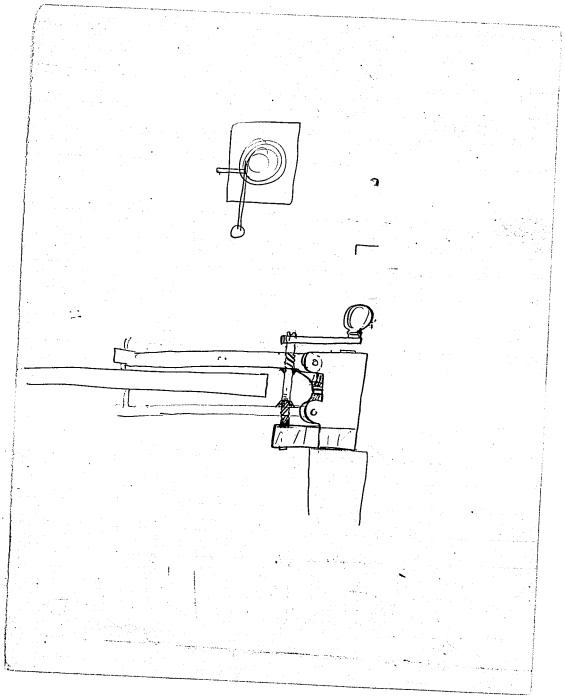


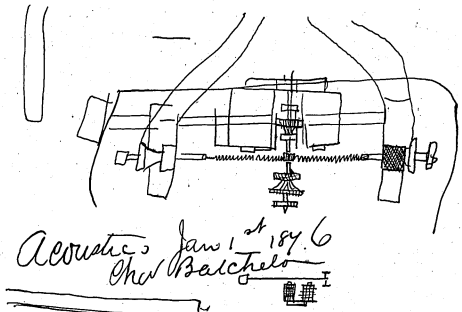

15
21
Burton
15.
5.
24





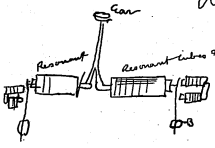

MAY 2 1876



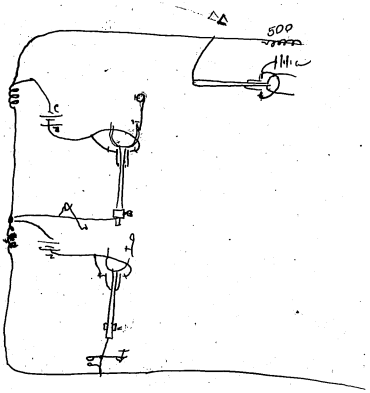

Acoustic, Jan 1st 1876
Chas Batchelor

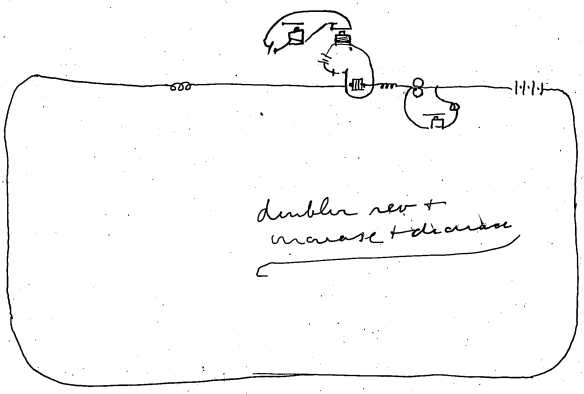
Received

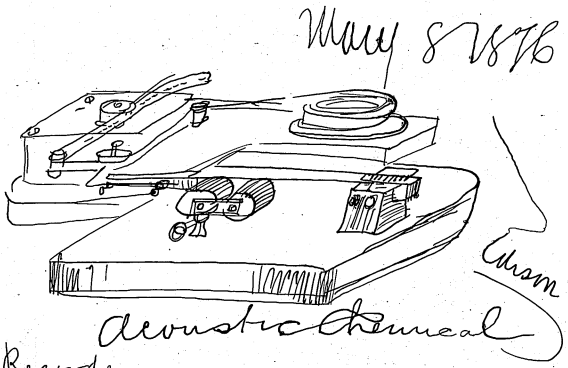
May 8 1876



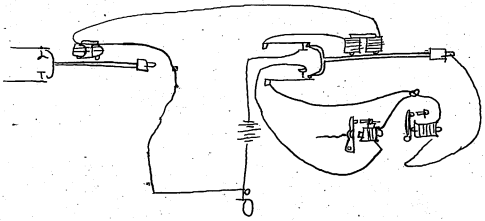
one reed one note higher than other
1st part of dot sent on one reed +
other part on other reed —
thus giving up + down shake
distinctive among the open to
read method | trouble


500

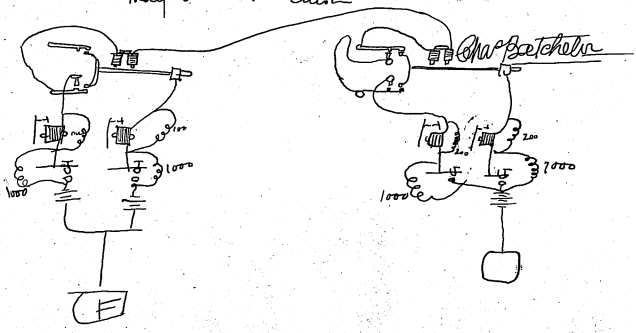

dumbbell rev +
marasc + discardase


May 8 1876
Edison
Acoustic Telegraph
Recorder

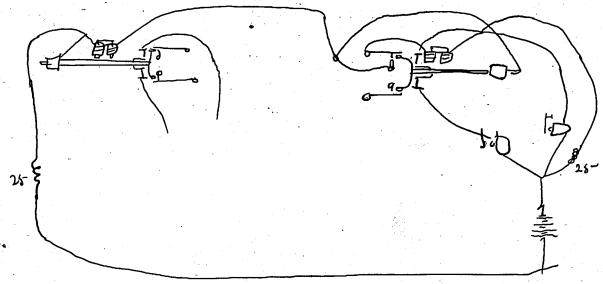
TRACINGS

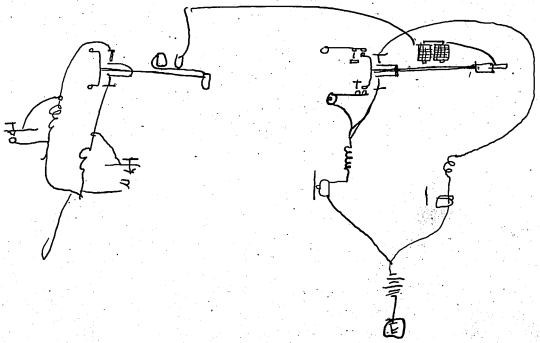


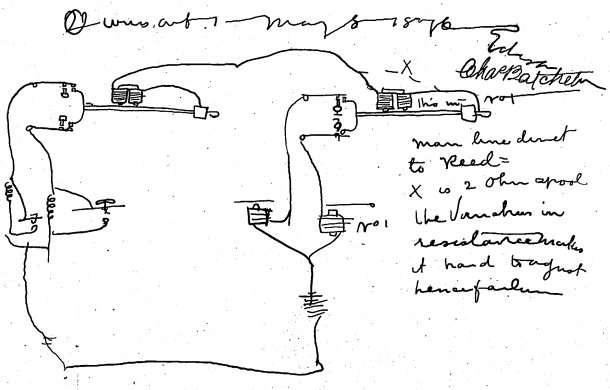
Keeping 1 line on two sets of instruments,
May 8 1876 Edison

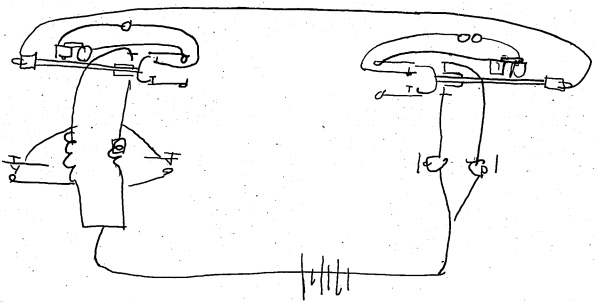


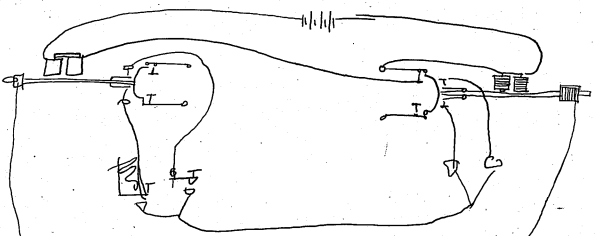
TRACINGS






X
this way
No 1
main lines direct to Read=
X is 2 Ohm spool
the Jamahan in resistance made it hard to get just



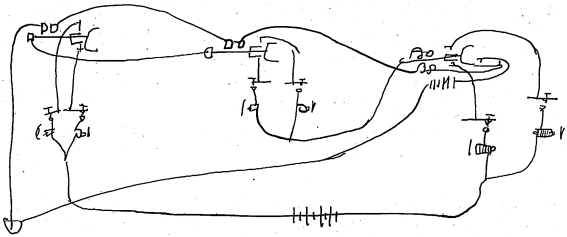


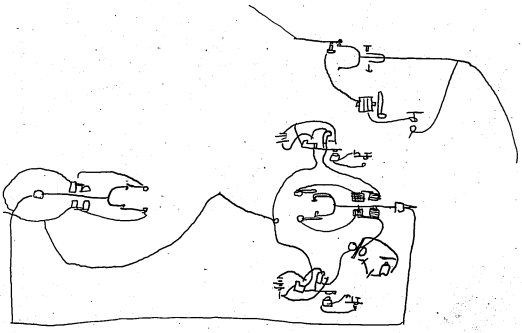
Works Beautifully

Apparatus whereby 1 wire with acoustic vibrations is made to impress another wire on two sets of coils at once ~~at~~ making 2 complete wires of a single

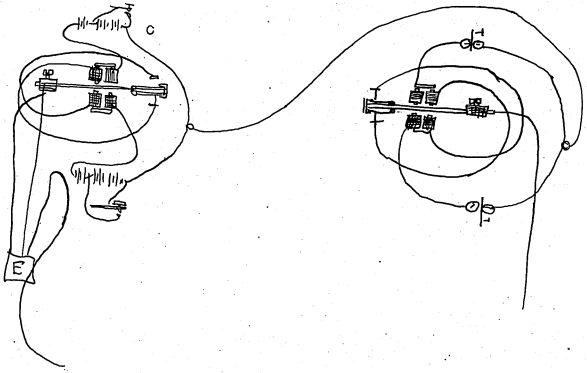
One = for instance 6 & my + Washm 1 wire
Can be the director with Alexander Reeds
this reed can ~~do~~ make Control &c as
to double 10 or 15 ~~more~~ more wires ~~used~~ both
through & with Tray Slatings
May 8th 1896 — Edison

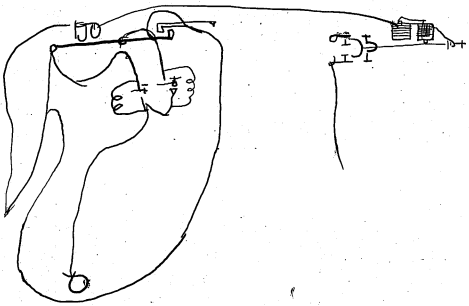
Same with a relay relation

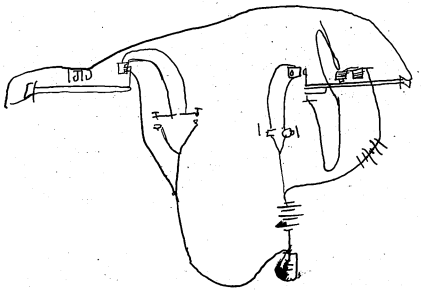


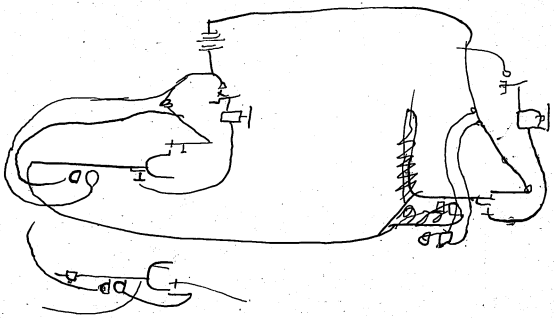


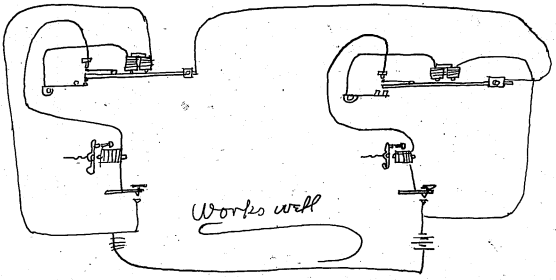
TRACINGS



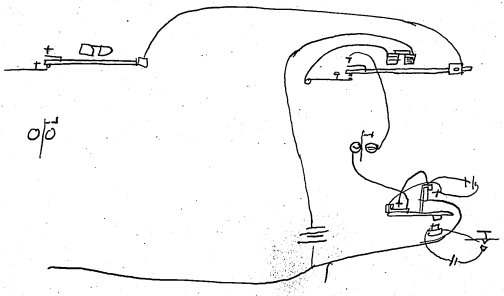


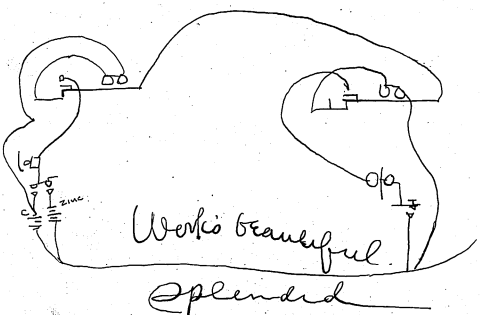






May 10. 1876



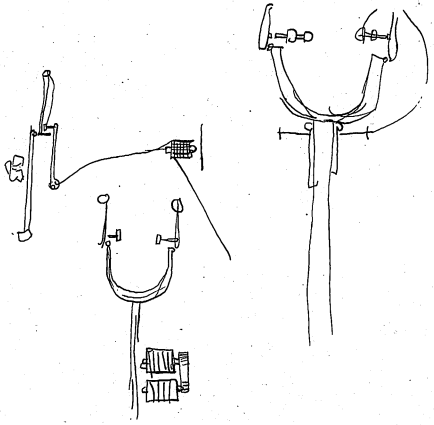


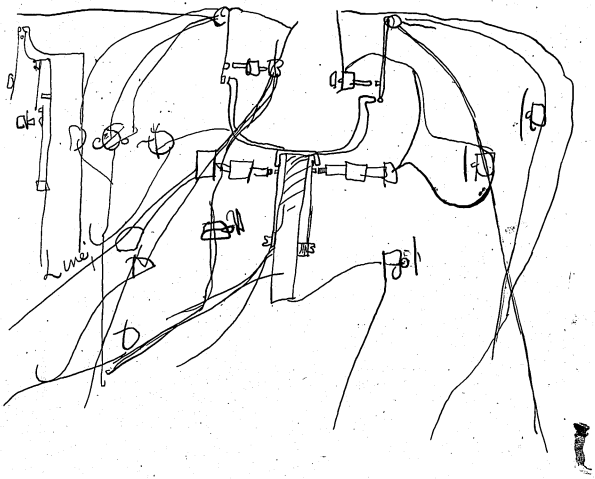
May 10 '18 '16

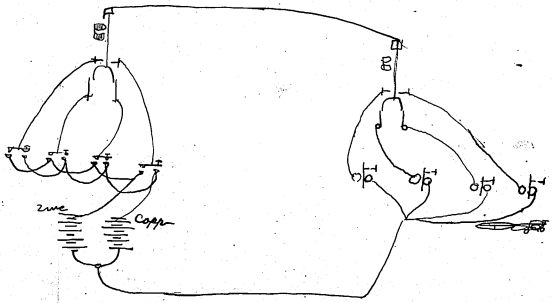
Even with a single strand ~~of~~ Litzkay with slight magnetism or extension for off wire work

Better than Commercial

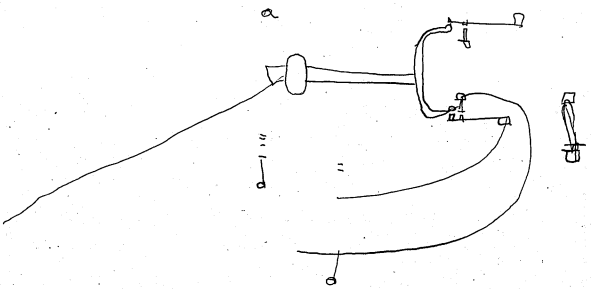
TRACINGS

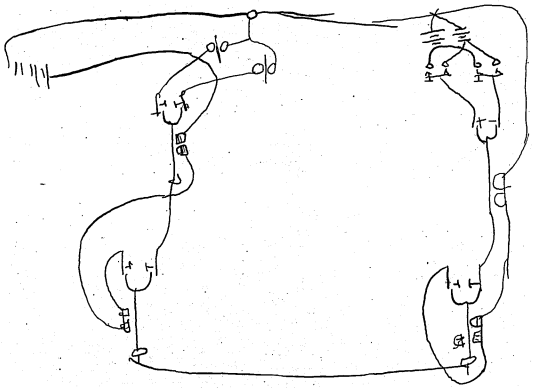




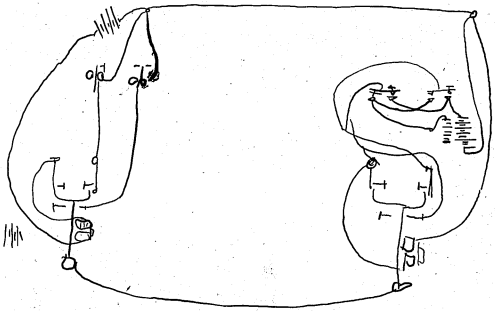

Zinc
Copper

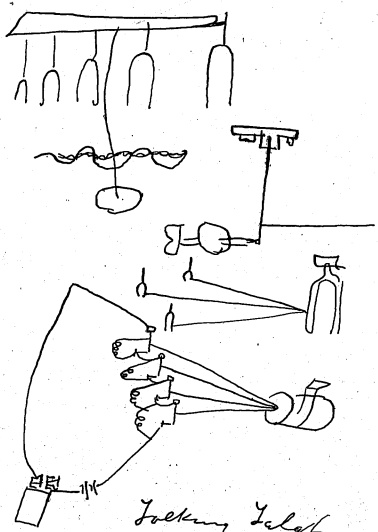
TRACINGS





TRACINGS



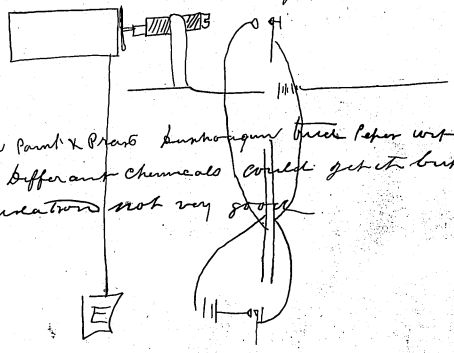


Looking Height
July 12 1878
Edison

Speaker

6th 1876.

James Adams



Platinum Point & Brass Sandringham Tracing Paper wet with different chemicals could get a trace but not very good

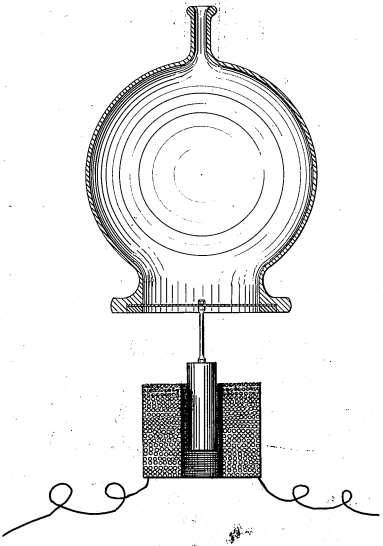
1876. Telephone (NS-76-003)

This drawing was probably made by Samuel Dittrich Mott in 1879 or 1880, but it refers to a device for which Edison claimed to have filed a patent in 1876.

[redacted] Telephone Record

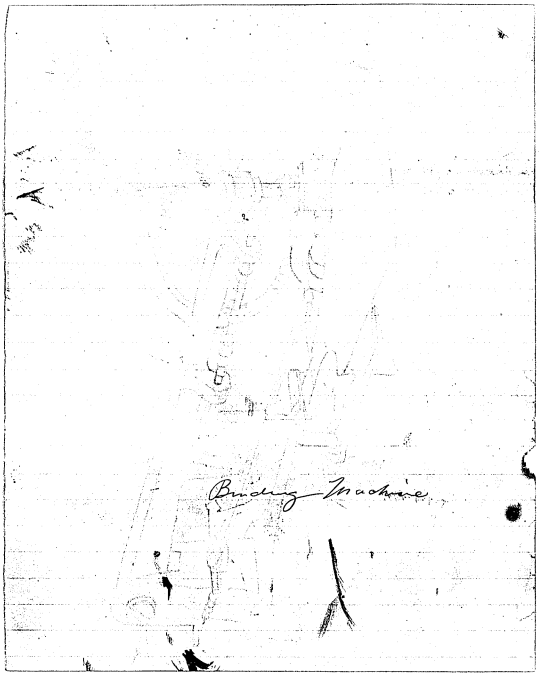
Filed January 14. 1876.

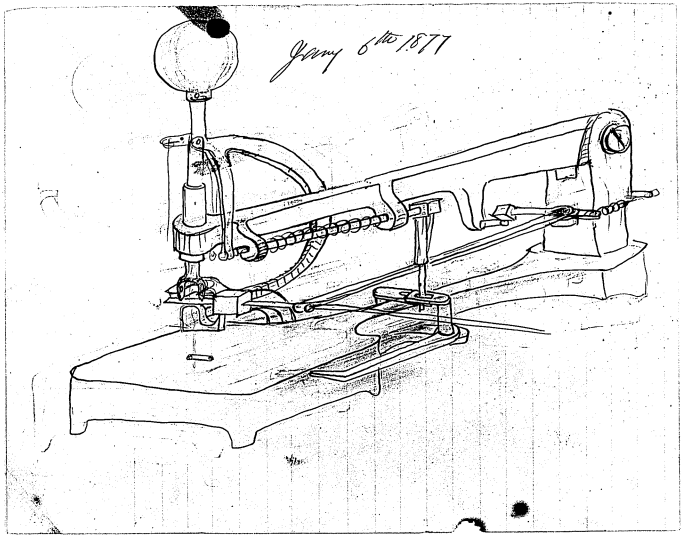
1 month before Bell or Gray

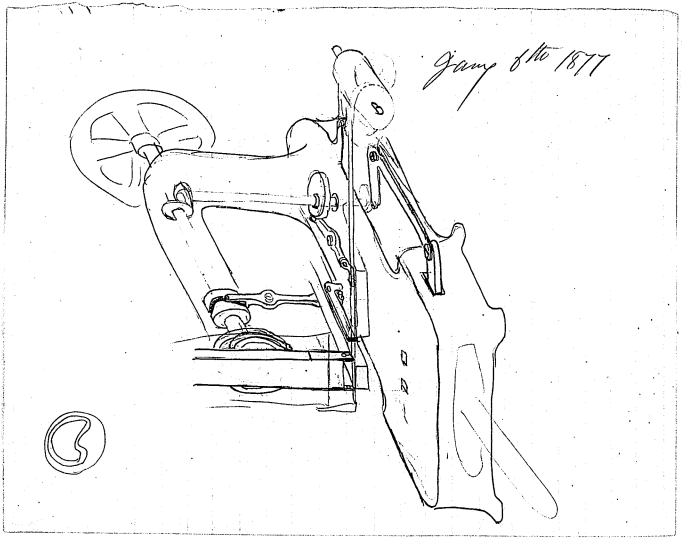


Edison's Magneto Telephone.

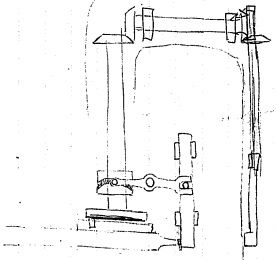
1877. General (NS-77-001)


Binding Machine

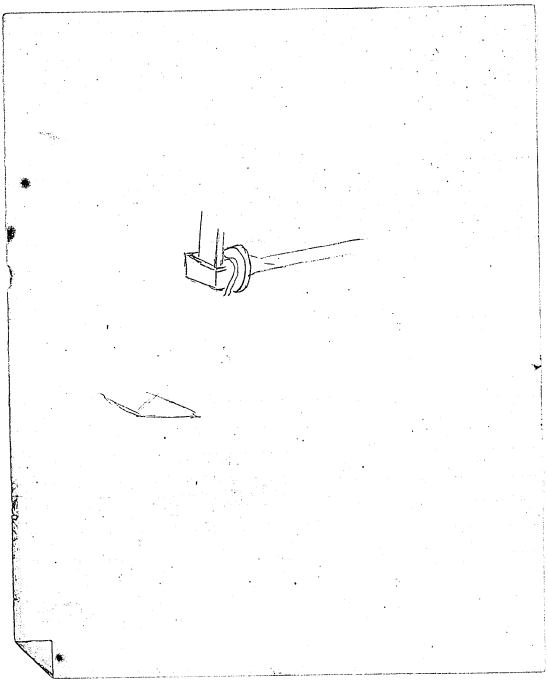

January 6th 1877


Jany 6th 1877

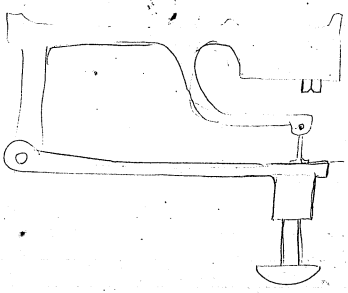
Jany 6th 1877

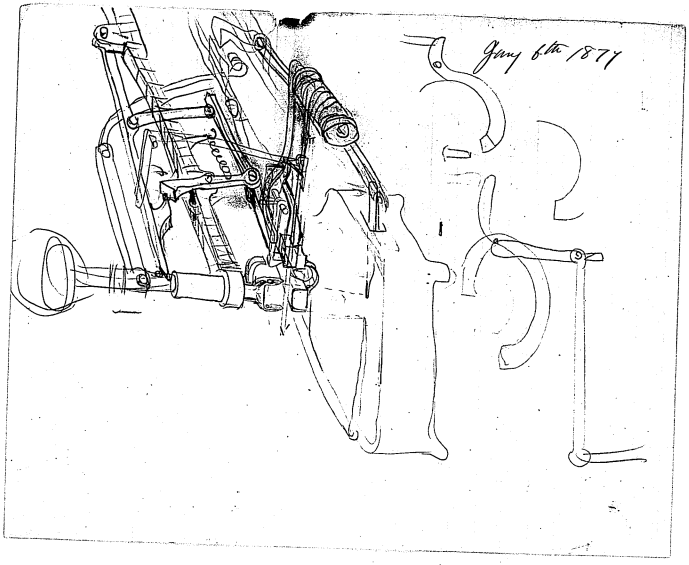


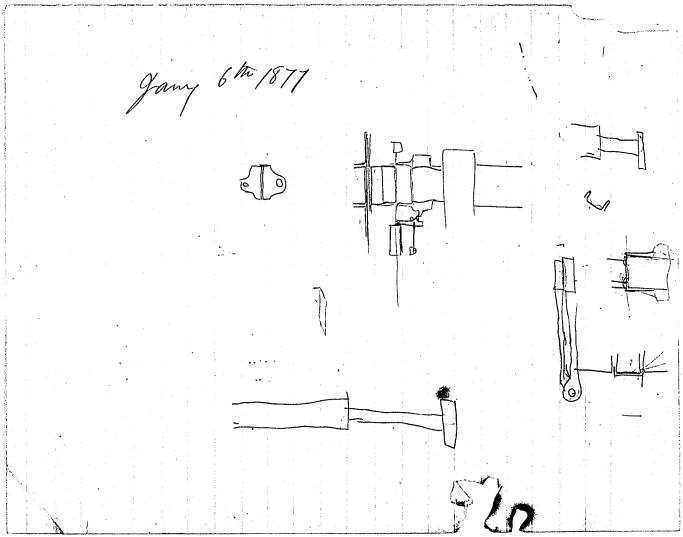
Jerm Cogill



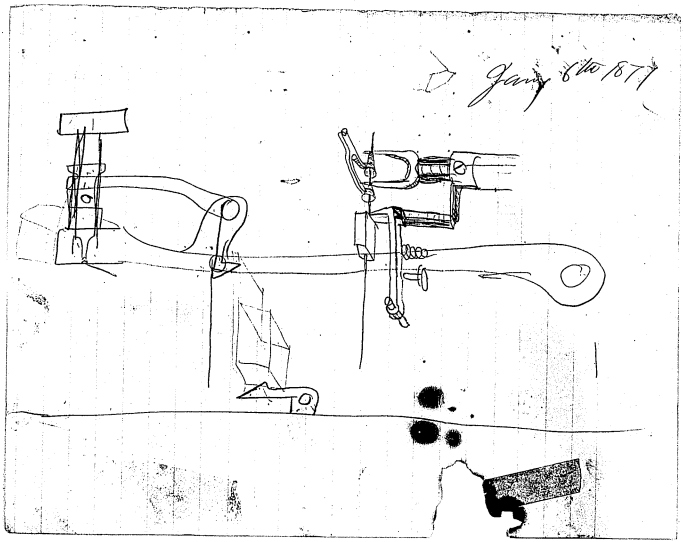
Jany 6th 1877

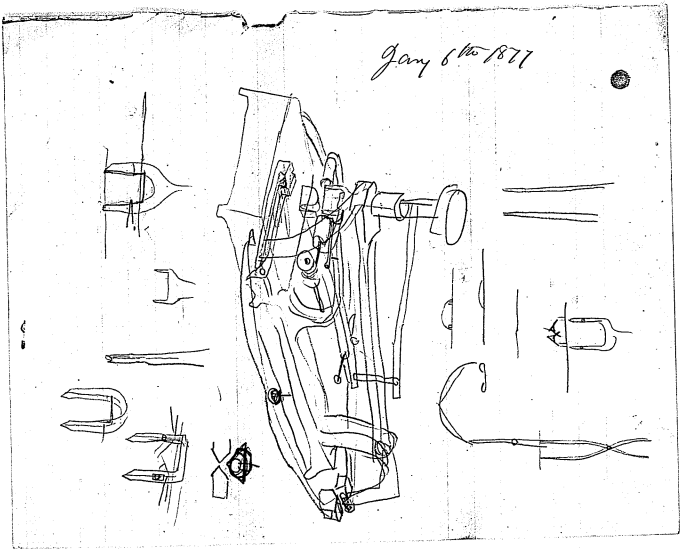


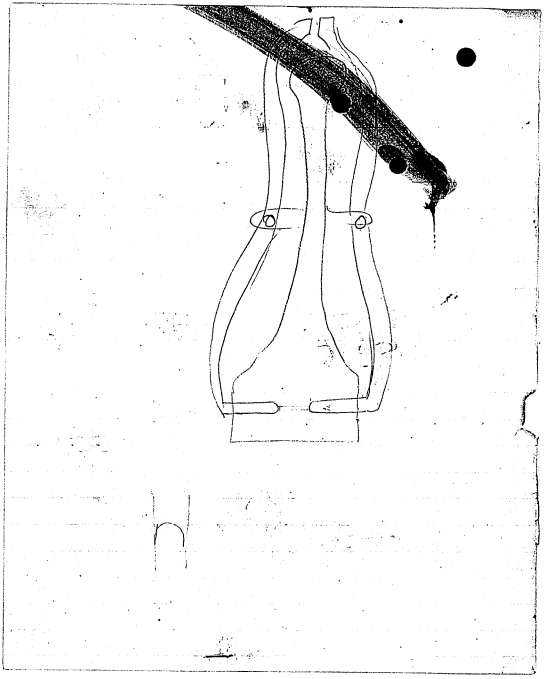

Janvier 6 bis 1877


Jany 6th 1877

Hold the wire
feed the wire
stop the wire
cut off the wire
bend the wire
close the ends
hold the paper

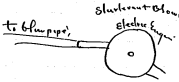

D. Jany 18th 1877


Jany 6th 1877



1877-01-10

Electric Engines for Fan ventilators



January 10 1877

Put polishing tools in Electric Engine Krugs now making =

Engine to Run a Music Box =

Little Lamp Engine fixed to a Clock to run it =

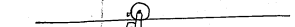
Electric Engine to Run a Siemens Ink recorder =

(Electric Alarms)

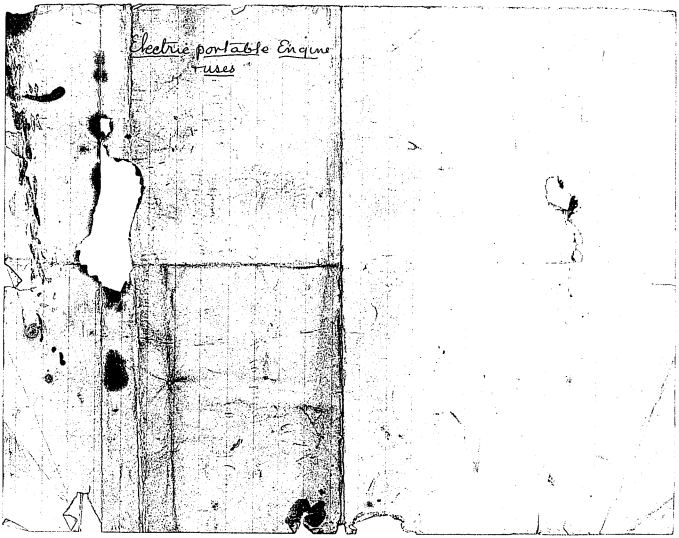
Electric Engines for spraying & Varnishing & working, for Household gas lighting for Chandelier lights =

Why not bind books especially those to be written in with rubber & leaving blank Ruled 00 books will lay flat ~~out~~ not pencil =

3000



With Electric Engine drill
Holder in upper end with for various
Diamonds Magnets arranged for
Cutting Glass Bottles


Electric portable Engine
Fuses

Hunting for Phenomenon May 7 1877

T. A. Edison
Chas Batchelor
James Adams

Turpentine Pyroxylic spirit - paper immersed for 2 or 3 months in liquid becomes brittle and can be kneaded in the fingers, but not like that in white Thymic -

you see two ends of the paper by holding bottle containing small quantity fluid at angle -

Iodide of Hg (Red) in Alcohol apparently insoluble yet 9 fundin 2 or 3 months that most of Hg has gone up by some action on side of bottle towards light above the solution & balance has gone up the slip of paper to top of bottle

Notes

May 26 1877

Liebig + Kopp Repts Vol I

P. 114. describes train spinning fan revolving in oil =
= big Leyden sectional area tube, tinde[illegible] lower wolt. 116 p.

Faraday
Chas Batchelor

Bellani. discloses observations of Gallotti that tightly stretched membranes
– free air sound only on during changes of weather – no sound obtained
in weather fine. rainy or very windy weather =

Blue ink – Paris blue in oxalic acid Vide p 155–

p. 227 = 9 wipes from the statement that polarization measured by
Cobb that the E.M.F. will walk better in cold than
hot weather + better when the paper is not
steam as fast as to heat the platina points –
229 = 9 wipes when but little Sul Cop in Callaud
Daell + other in series have plenty that cell
will polarize as Chromic is greater than there is
Vitriol to decomp hence appearance of Hydrogen

237 = Auto Circuit breaker Neeff. 1839 (2)
removed by Forment Paris 1847 = (3) =
238 = in Electric light Carbon points being separated
the arc is regulated by the discharge of a
powerful Leyden spark from Carbon to
Carbon this carries over particles &
Establishes the Circuit –

(Continued)

May 26/77
Tuesday

rod of conducting substance Hg etc through which current passes, surrounded with a voltaic wire placed on the pole of a powerful Electro magnet page 239 Magnetism

242 = says best way get oxygen used conc sulp zinc with undissolved crystals = Note of think in my Emg Experts of mixed + metal in boole pounded add from chl zinc + one or 2 others phosphat of iron of think -

Hg chl made Lime + Sugar - also chl Lime with Sol of Lime

Poggendorff

p 380. = says that Hydrides of metals only finely divided metals in says neg pole Volt bat with Tellurs antimony

1411 = has mistaken - 1 of 1

61 Vol III - Sainte-Preuve: proposed 1849. Guild Telgh of solid rods in tube filled with a liquid + Immersed Voltaic

Vol 4 - p83 - Page says Trouvelyan voltaic may be made 40 Sheets shows how

Continued

May 27/77

33. P. Vol II – Liebig's Kraft

to Salicine) drop of iodine in Iod Pot. add anise or fennell oil drop by drop agitate mixture a gelatine mass produced which on adding Alcohol yield pulverent & whitish with Al. 2433 Ring white. highly Electric = fuses 160°. to Vitreous on cooling

Chas Batchelor

Vol 14 P 10

chip your hand in Ether then in boiling wax or Mutton fiend. et feels casual =

By putting the eyes close by good aged print at a point where the printing appears very blurred and double images of the letters the fourth double letter will appear blue, to which

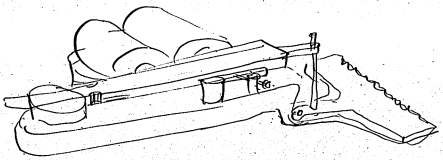
July 21 1877

Sheet rubber quickly sterilized
Organs heated suddenly allowed
to resume its normal position
at body [redacted] colder than body
normal temperature

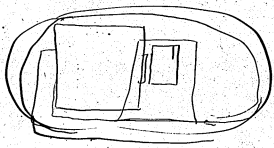
If a strip of vulcanized rubber [redacted] inch
long 2½ wide be placed grasped by the
hands at each end the center between
pressed on the lips the slightest
[redacted] commences to [redacted]
[redacted] Subject to [redacted] cold
[redacted]

Horse Clipper
worked by Arsenate
Reid =

Aug 6 1877
JA Allen

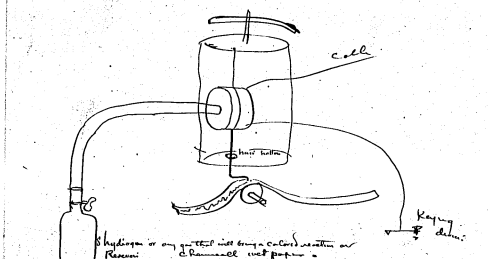


100

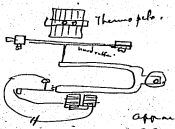


Recording Galvanometer

Aug 7 1877



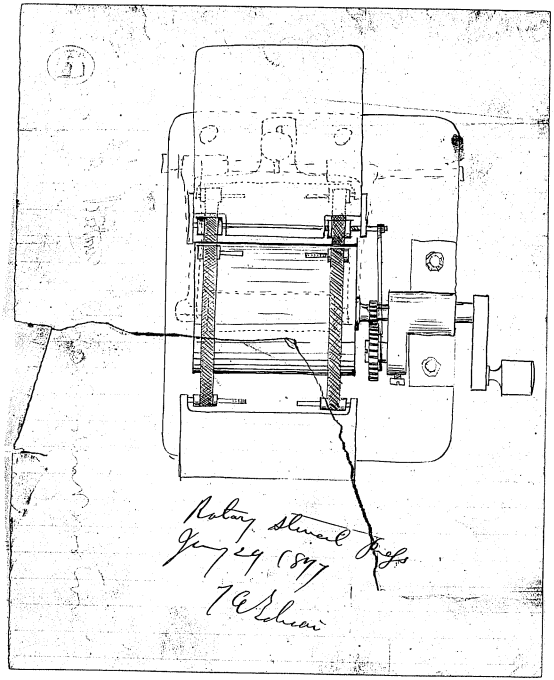
September 6 1877
T A Edison
Chas Batchelor
James Adams
J Kruesi
Ludwig Boehm
Max Schupmann



apparatus for transforming heat-waves into Electric waves

I notice with the said vulcanite that after you have worked it for ½ minute or so it is far more sensitive in producing that the heat + cold waves + the loud again & the mouth after working strongly for ½ minute than the slightest movement will cause these waves to be felt =

1877. Electric Pen and Duplicating Press (NS-77-002)


Rotary Stencil Pens
Jan 24 1887
T A Edison

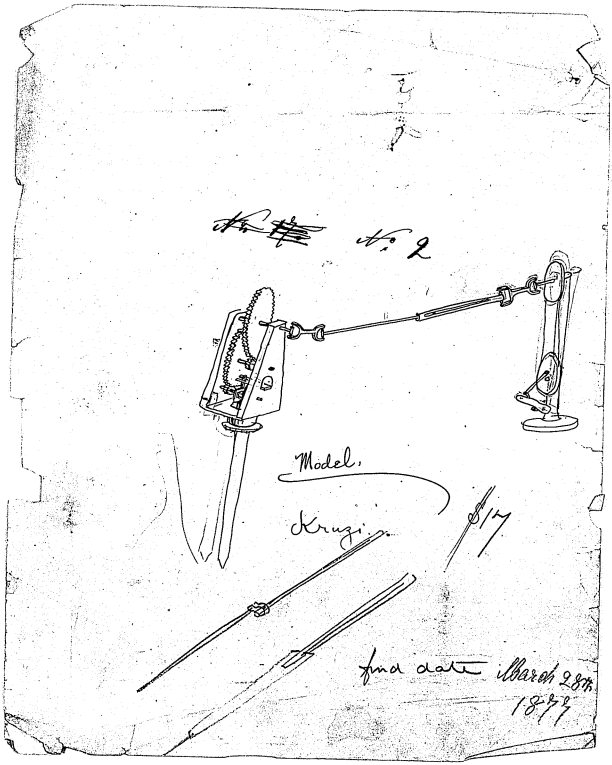

No. 2
Model.
Kruzi.
8/14
Filed date March 28th
1877

Fig. 6. & 7.

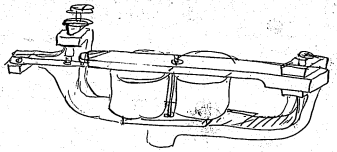
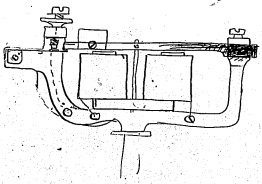
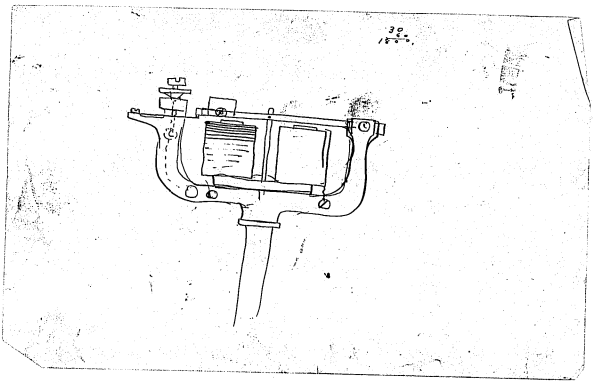
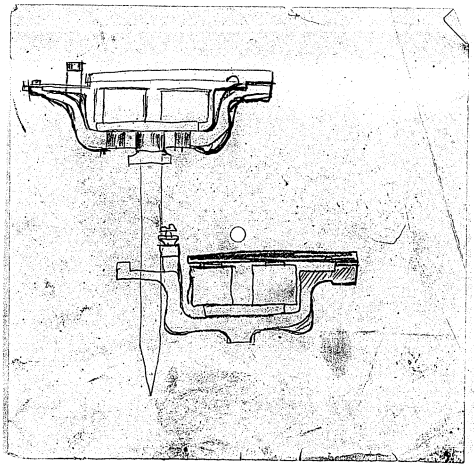


Fig. 1 Delivered Sept. 10th 1877
Fig. 2 " " 11th "







Sept 30th 1877

Copying Experiments

A number of copies at once

1 Wrote with liquid arsenic Acid and let dry, then we soaked piece of blotting paper with aniline violet and Glycerine and took impression in copying press by pressure very slight at first—

Result The ink also soaks through the paper and even with bond paper the press presses it through in some places

2 When we wrote with ordinary Ink with a little Acetic Acid in it and dampened the sheets with water that had alittle Arsenic acid in it we could get 5 copies at once on tissue paper

3

Sept 30th 1877

to find a oil or other Liquid that will not go through

Paper

oil Cade goes through quickly

oil Organum goes through, but dry very fast—

oil Cajaput " "

Balsam Copaiba " " slightly

Balsam Peru " "

Neats Foot oil " "

Union Salad oil " "

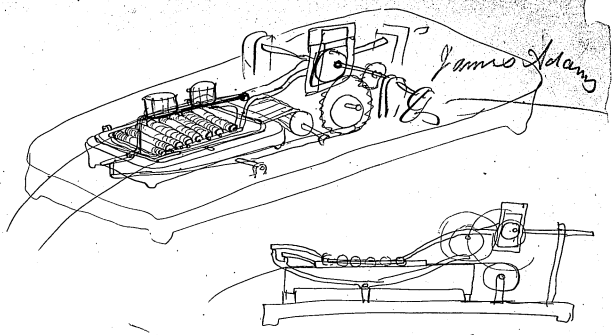
Sperm oil " "

James Adams

Autographic Printing

June 10, 1877
T. A. Edison

James Adams



Autographic Stencil Press —
Continuous Roll printing

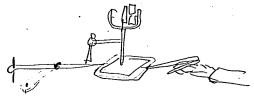
I have tried the stencil on a Gordon press with a cloth [illegible] sheet for good printing = I propose to put a hair spring which are to take the place of the regular roll on the Gordon Press and instead of pressing =

Autographic Printing

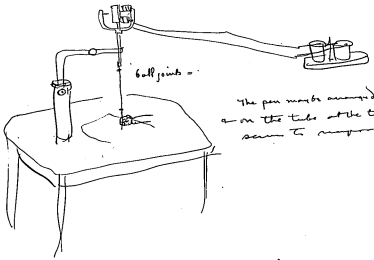
June 10 '15
7 A.M.

I write on a high hard sized paper with James' ink or Acetate of Manganese. This dries & allows ink to pass through quite many impressions =

I claim writing on proper paper with Arsenic acid or acetate of manganese & filling the Stencil cut writing with gum for the use of the Blind =



By this arrangement you move the paper instead of the pen

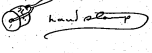


The pen works accurately to whatever the shape of the table of the top of the cam which causes to impress the needle.

Autographic Printing =

June 10 1877.

I proposes to coat hard rubber with a Conducting substance for plastic Electricity & write on it with a point then bearing the hard rubber & then proposes to Electrify it & dust it over powdered dry carbon or Lamp black & take impression from it. or coat rubber with a Conducting substance write on a piece of paper with a substance which when pressed on the rubber will take off the Conducting substance & leave rubber bear ready for Electrifying.



I just tried regular thick printers ink with a pointed & find that with rolling it too sticky but will work by pressure

James Adams

Autographic Journal — June 10 1877

Boston

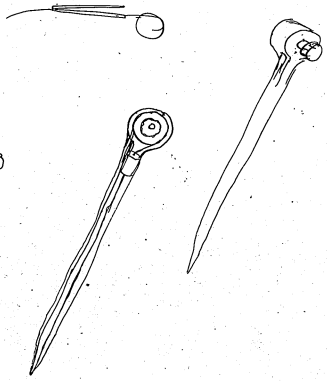
Make a vibrating bar vibrate and attract a magnet to write the way

James Adam

Boston

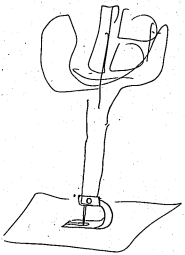
Boston

Boston



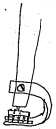
Electric Pen

June 10 1877



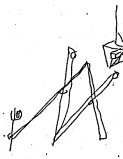
Works with.

I have a new process for duplicating and it work well I take hand copy of paper coat it with wax on one side, cold then write with a point, the scratches the wax away where you write, I then wet a pad with aniline ink & lay it on the wax side in writing, the sheet then waxed on the other side the ink comes through where the wax is scratched away it off sharp. Can be taken



music drawn several needles

James Adam



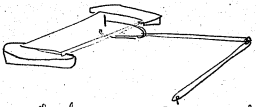
Pantograph with Electric pen

I propose to write with an amalgam of Mercury & sodium by the a smooth iron plate, and it will amalgamate where written the iron. I then connect iron to Zinc of a Bell & mount my paper on Pewter and de polarize Tact key, to iron & from the another metal plate connected to the Carbon pole of a battery. The interposing will prevent the iron receiving + & it will [illegible] as a Blue [illegible]

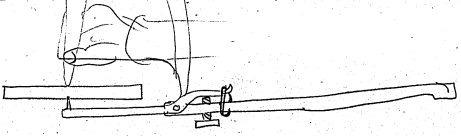
Autographic printing

June 12 1877

T A Edison



Sheets covered with plaster of paris & scratch medium with stem shellac'd or other material when filled with thick varnish and dried & polished it forms an almost unexhaustible negative. perhaps grease or paraffin would be better than the shellac



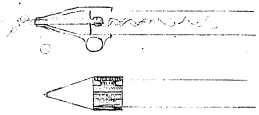
June 20 1877

(No 36 Fig 10)

Fixing Chuck for Tin Foil Glass
in Electric pen.

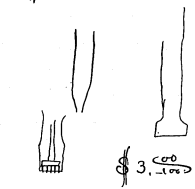
$2,50
1,00

Edison



June 20 1877

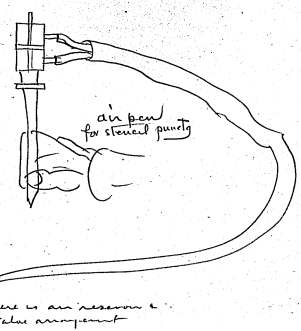
Electric Pen for Music



$3.00

Puncturing pen

June 21 1877
T A Edison

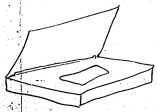


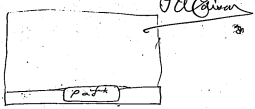
new process of coat thin high sized paper with a flexible varnish which never dries, or with paraffine ouabaian ouabolance, I coat it on one side only taking care that none goes on the paper itself I lay this on a hard surface and write which a stylus or sharp point this scratches off the paraffine or varnish and I sponge the varnished surface with Hydrochloric or Arsenic acid this eats the size of the paper at the point left bare and then I lay the varnished side down on an ink pad & the thing acts as a proxy stencil for taking any number of copies

Multiple Copying Process

June 26 1877

T. A. Edison





Message from New York.

To T. A. Edison May 7th 1878

do you wish us to come to Morrow morning sig ~~Edd Walker~~

Ed Walker

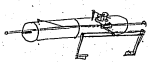
Com to-morrow morning

Sa

By Batchelor

Autographic Printing. June 27th 1871

James Adams



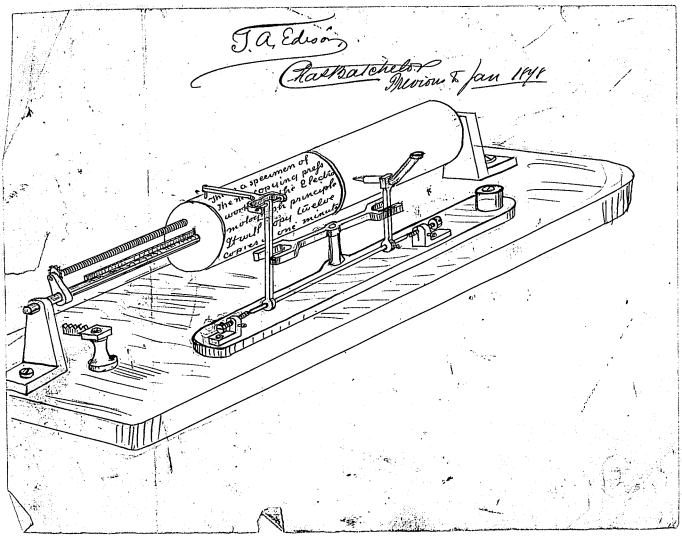
write on paper with Collodion Electrify the MSS by rubbing with dry substance a dust Aniline dust over a flat surface with a sieve - put Collodion sheet MSS in frame & Power it while Electrified with 1/32 inch of the Aniline dust all about the particles & these adhere to the Collodion MSS. can be transferred to a wet sheet the Collodion MSS is dry with which you print from the transfer sheet another dry re-electrify & go over same process.

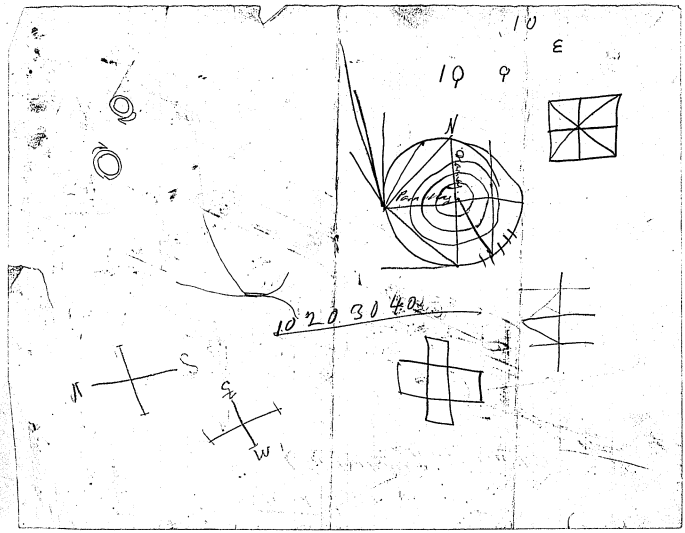
Taking Multiple Impressions
Autographic Printing

June 29 1847
Talbot

James Adams

Just discovered a trivial first-class process for Duplicating Letters Etc = I take a piece of paper, not slightly Gelatine, pass it through a bath of Collodion scraping off excess but it dry then lay it on blotting pad & write with a stylus. If in the least slightly embossing it & the object is to break the Collodion when it is written on & the object I used is an ivory paid the ink will come through where the Collodion is broken upon the mass may be duplicated to any extent = I find that the gums in Alcohol or other Menstrua will do the same thing. In fact almost any substance that causes the paper to be impervious to prevent the passing of ink through can be used = Even printers ink thinned by an oil can be used although a Indian or Colored ink works better =

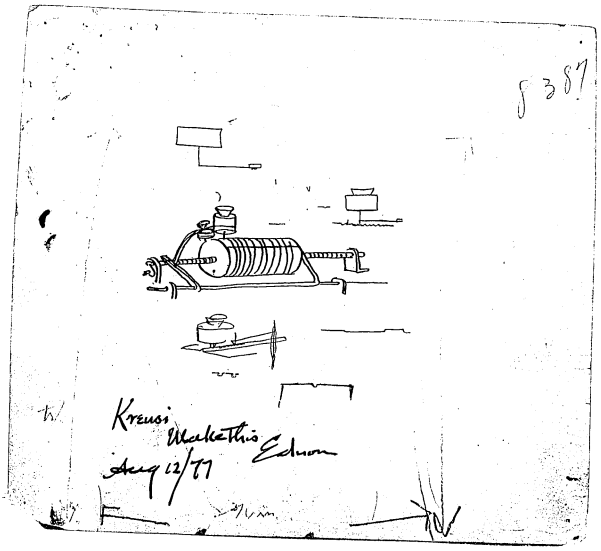

T. A. Edison
Phonautograph
Invention Jan 1877


10
E
10 9
N
10 20 30 40
N
S
E
W

1877. Phonograph (NS-77-003)

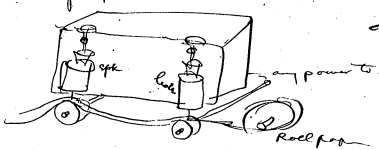
Included in this folder is a drawing containing the inscription "Kreusi Make This Edison August 12/77." Although this was once considered to be the drawing from which John Kruesi constructed the first phonograph, the evidence suggests that the inscription was added at a later date. It does not appear on the reproduction of the drawing in William K.L. Dickson's biography of Edison, published in 1894, nor on the reproduction in James U. MacKenzie's obituary in the Electrical World in 1895.

This folder also contains facsimiles that were prepared for use as exhibits in the case of American Graphophone Company v. Edison Phonograph Works. These have been filmed after the other notes and drawings.

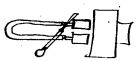

J 387
Kreusi
Markethis
Edison
Aug 12/77

Phonograph

Aug 12 1877
Tatlow



Input – Bell Telephone ~~connect return~~ on end of pole. Tang clear across diaphragm;
also

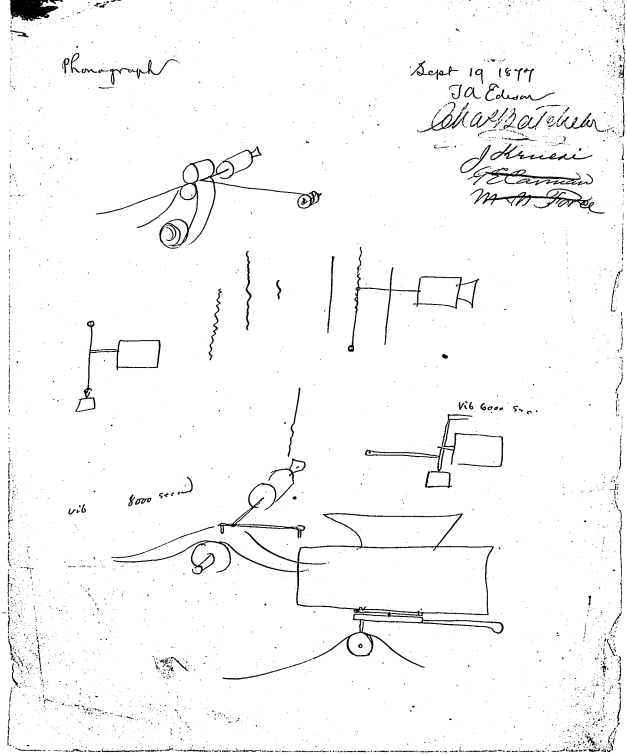


– ~~wrong~~ short ckt permanent magnets – iron frame
– cup between diaphragm & pole allowing speaking tube to pivot on cup –

Phonograph

Sept 19 1877

JA Edison

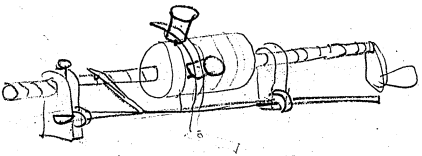


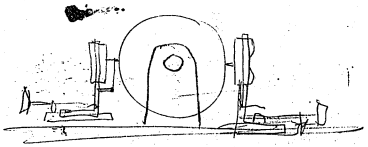
Phonograph 1877 Large

582

Phonograph.

Nov 29th 1877
T A Edison
Chas Batchelor
J Kruesi





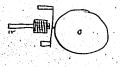
Dec 3, 1877.
7a. Editing

Autotelegraphic Telegraph

Wefound that a very good dimen for transmitting is to emboss tin foil paper & cause indentations to rise & lower a Contact Lever =

James Adams

Phonograph –



Recording by magnet work of Automaton
Strong as with voice, requires ear loudest
Telephone to do the big –

Amer. Grapl. Co.
Edison Phon. Work.
Defendant's Exhibit Phonograph
Sketch Sept. 9/77.
E.C.E.

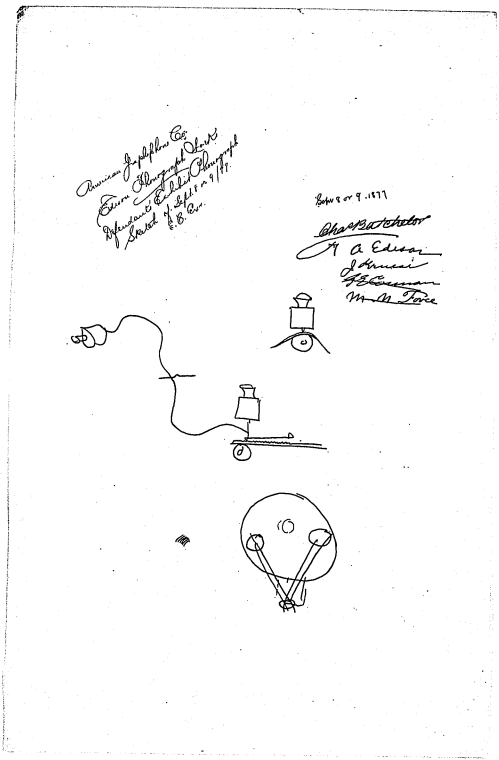
Phonograph

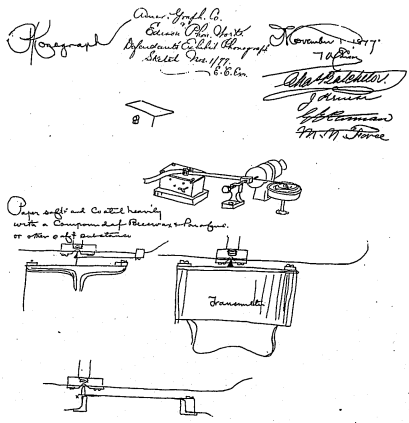
September 9 1877
T.A. Edison
Chas Batchelor
James Adams
J. Ludwell
[illegible]
[illegible]

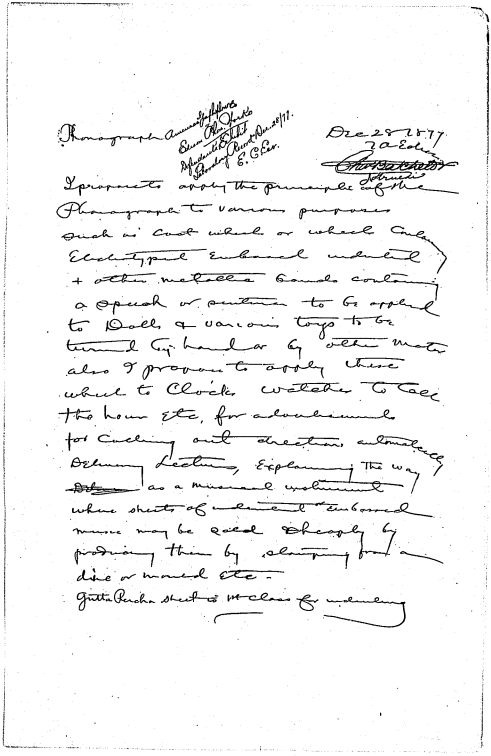
The mdgr. X. might be a pencil or other substance which would make marks =

We tried ink in this =

ok =




Phonograph
Amer. Graph. Co.
Edison Pat. Nov 24
Defendant's Exhibit Phonograph
Sealed Dec 11 77.
C. E. Co.
November 1877.
8
Paper roller and Cutting knife
with a Compound of Resin, Sulphur,
or other adhesive
Transmitter
X Reed diaphragm
Coupled to Tube

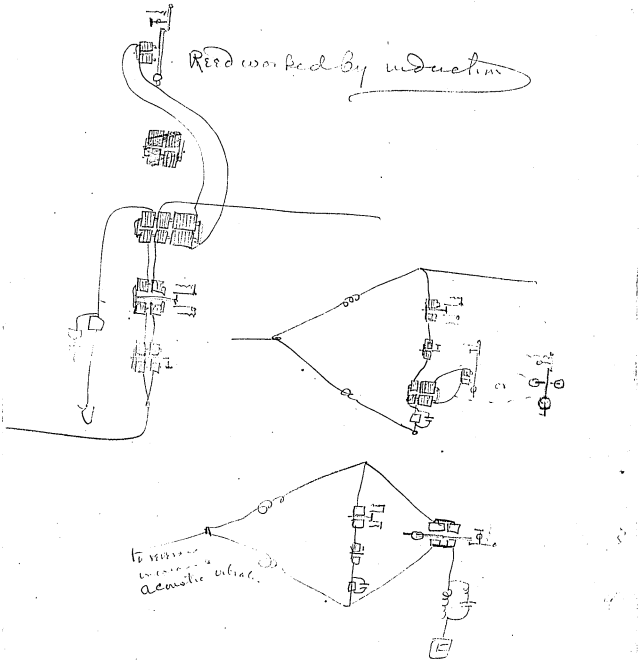


1877. Telegraph (NS-77-004)

Filmed in the following order: a series of notes and drawings labeled "Sextuplex," which were probably once clipped together; other notes and drawings; tracings.

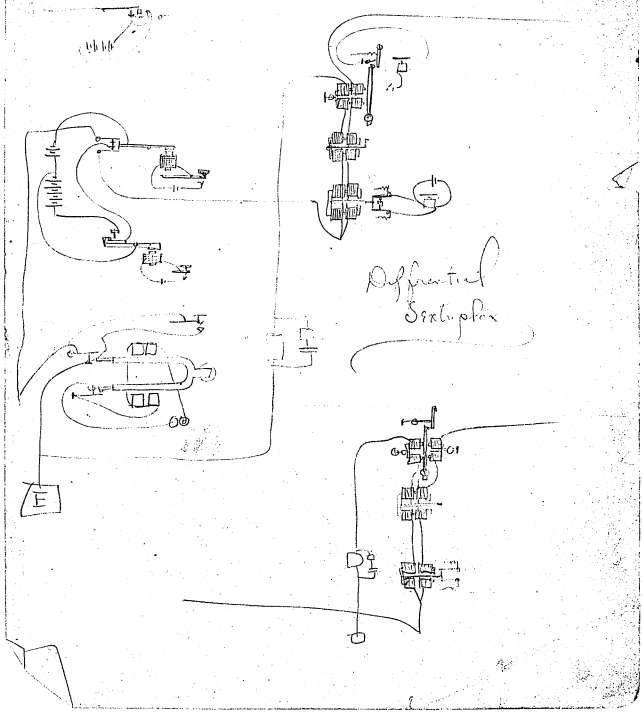
Duplex

April 4 1877
T A Edison



Sextuplex

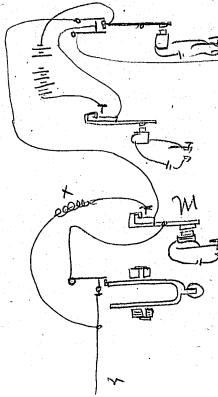
April 4 1877
TA Edison



Differential
Sextuplex

Octuplex

April 4 1874
T A Edison



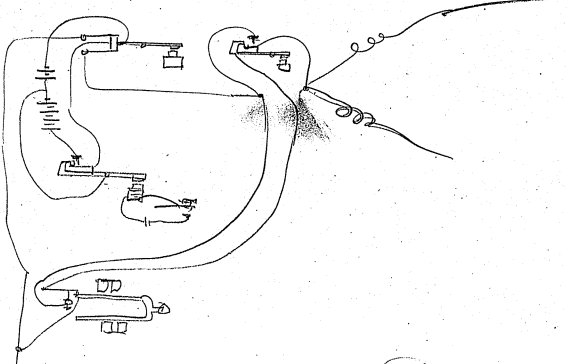
object of X is to cause even
sympathy between the vibrator
when the Current and when
they Cease it changes it
hence when 9 stop 9 throw
in a Resonance =

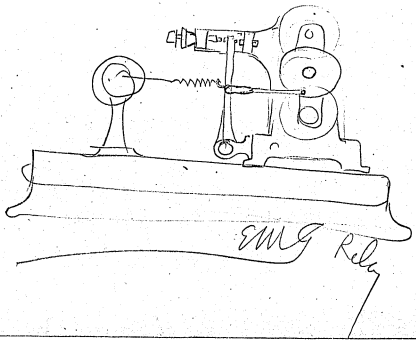
Octuplex is made by
mounting another tuning
fork at right angles to it
connected to the Earth
& then is connected
exactly like the re-
sharon but has a different vibration rate
and other forks may be mounted as long as
they can be arranged so as not to
interfere with the regular pole
& makes Current Reverse
If multiplying the Combination is good
& it is not found necessary to use
M. it may be omitted.

Sextuplex

April 4 1877

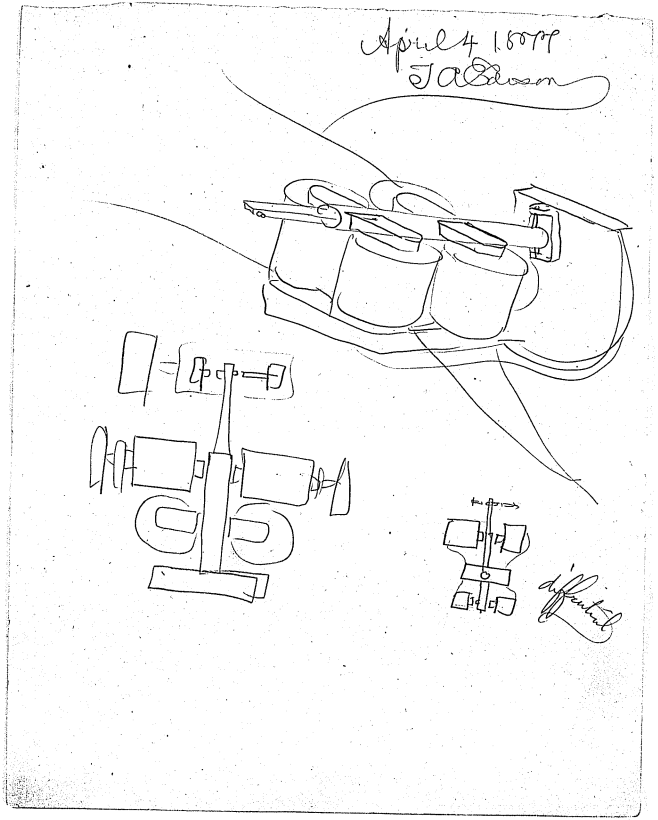
J. A. Edison





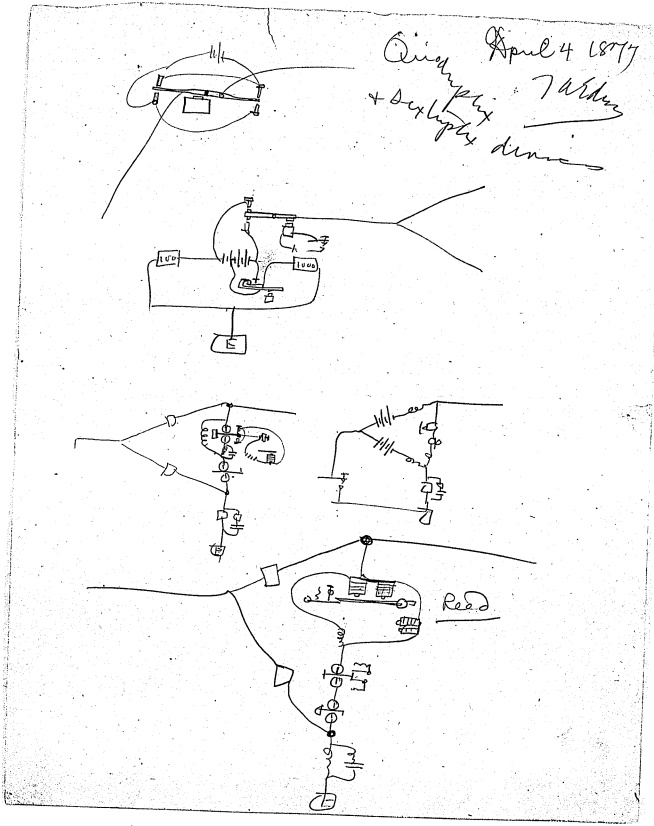
EMG Rely

April 4 1877
T A Edison



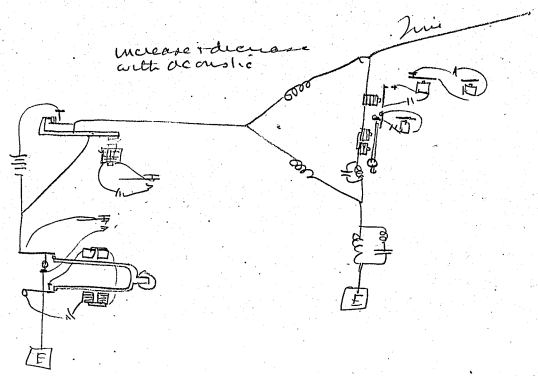
April 4 1877

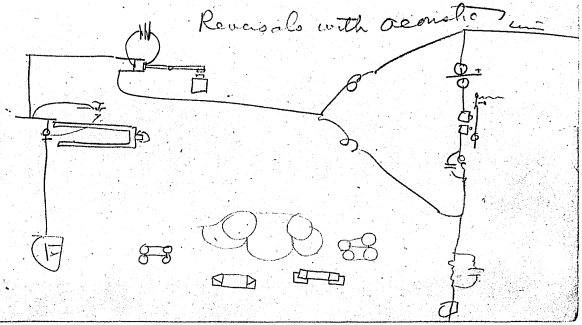
Quadruplex
+ Duplex diagrams

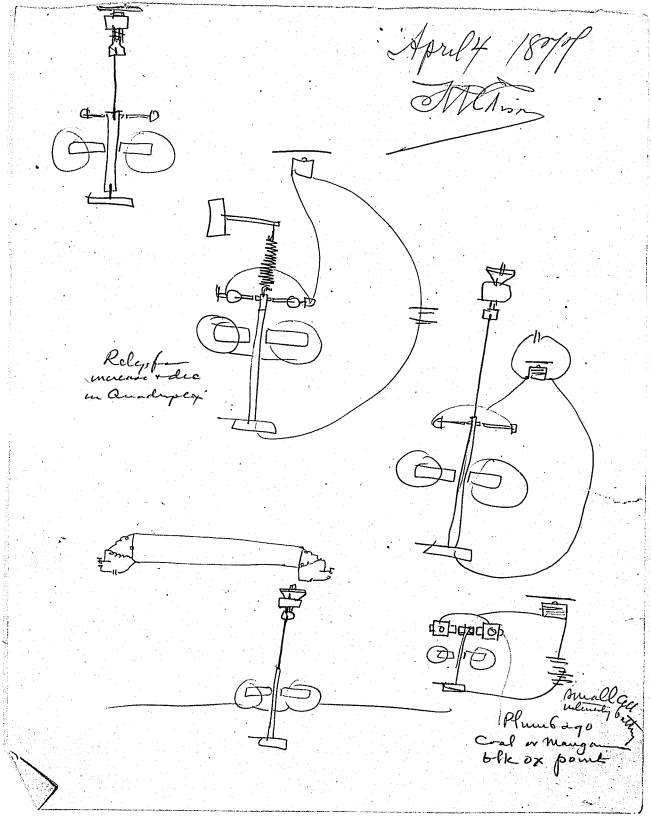


Quadruplex

April 4 1874
Th Edison






April 4 1879
Relapse from incurable radical in Quadriplegia
Small GH ulcerated
Plumbago Coal w Mangan blk ox point

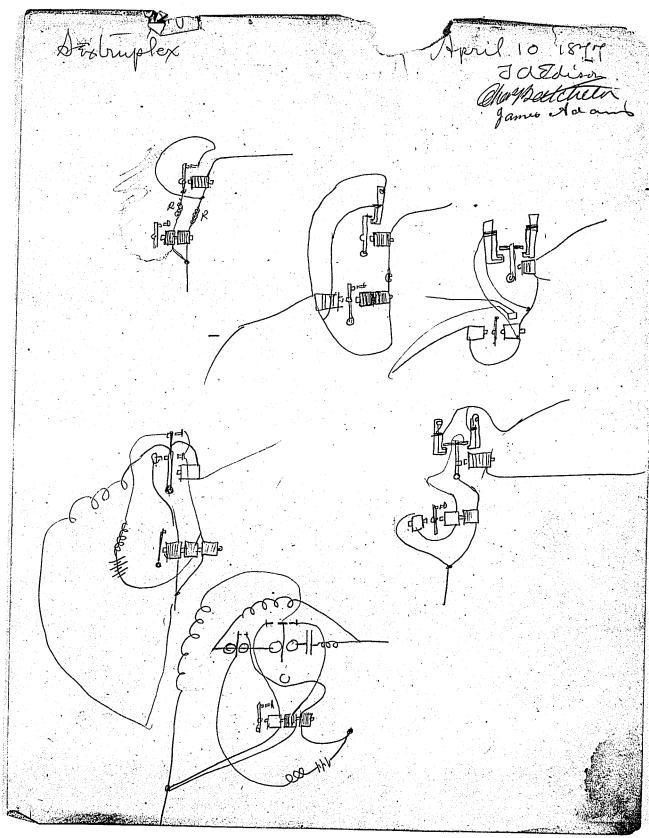
Diplexplex

April 10 1877

T A Edison

Chas Batchelor

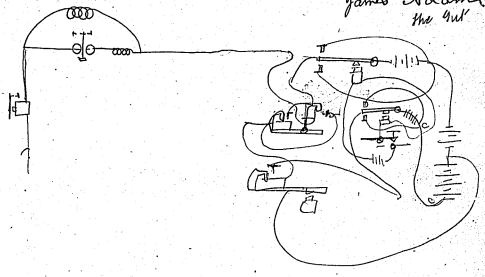
James Adams

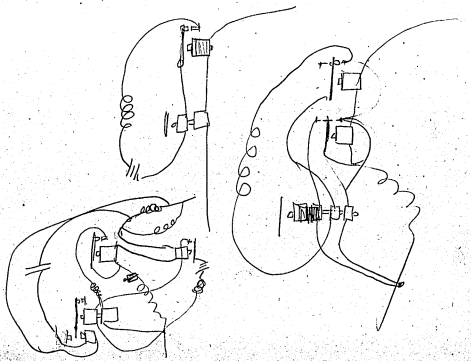


Sextuplex

April 10 1877 -
T.A. Edison.

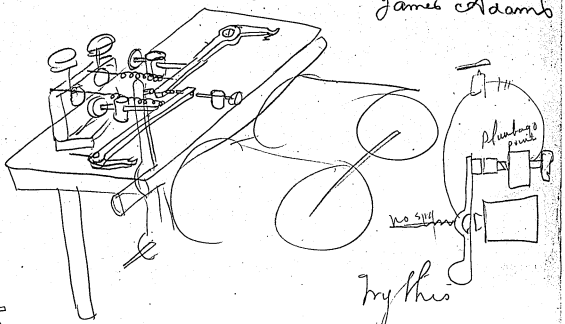
James Adams
the 4th

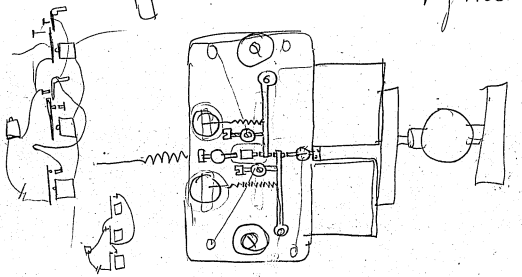




Electroplex

April 10 1877
T A Edison
per Waterhouse
James Adams

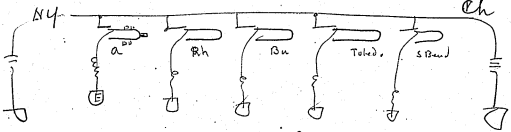




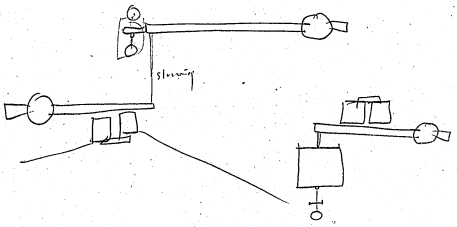
April 10 1877

T W Edw

James A Adam



discharge line by
tuning forks worked by
a Pedal



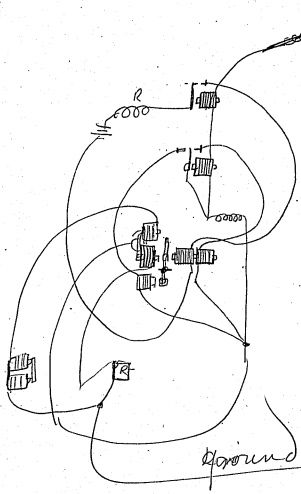
Extra Copy

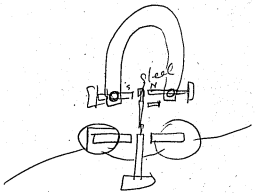
April 10 1877

Thomas A. Edison

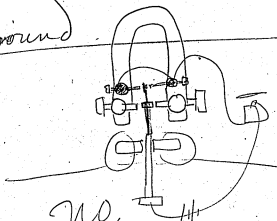
Chas. Batchelor

James Adams





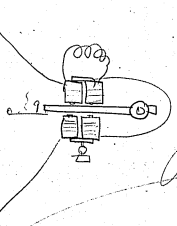
This makes it less sensitive to weak current.



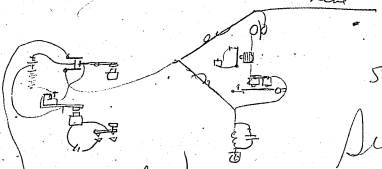
No. 11

April 10 1877
J.H. Edison

James A Adams
the artist



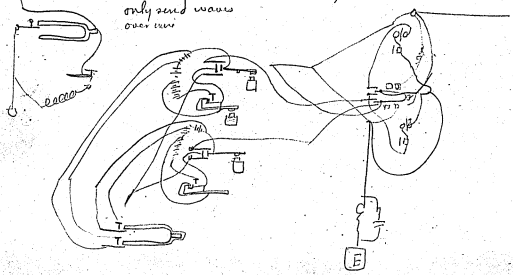
good



Same letter end

Sextuplex

only send waves over line

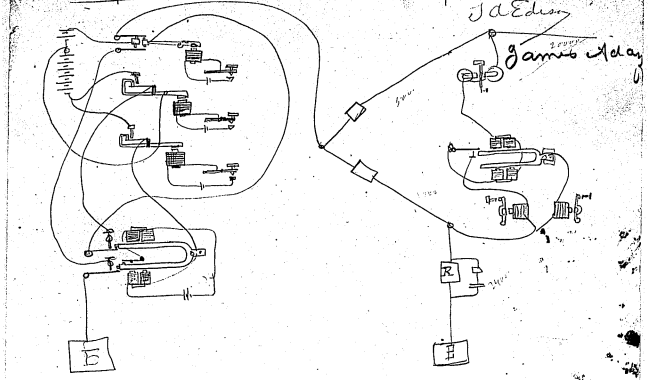


Duplex

April 10 1879.

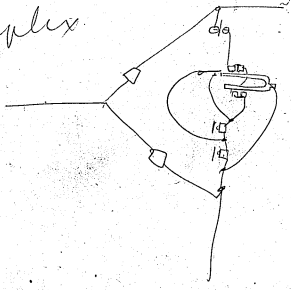
J d Edison

James Adam



April 11 1879

Duplex

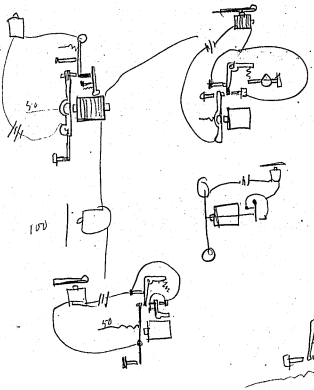


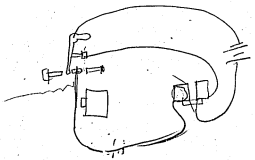
Duplex

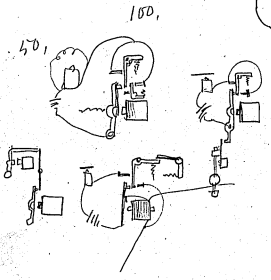
April 10 1877.

Thos A Edison

James Adams





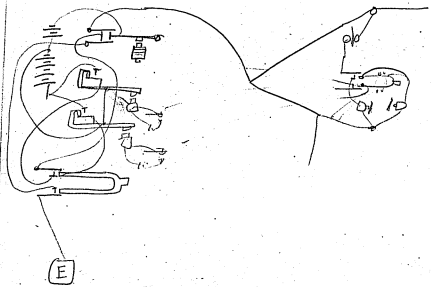


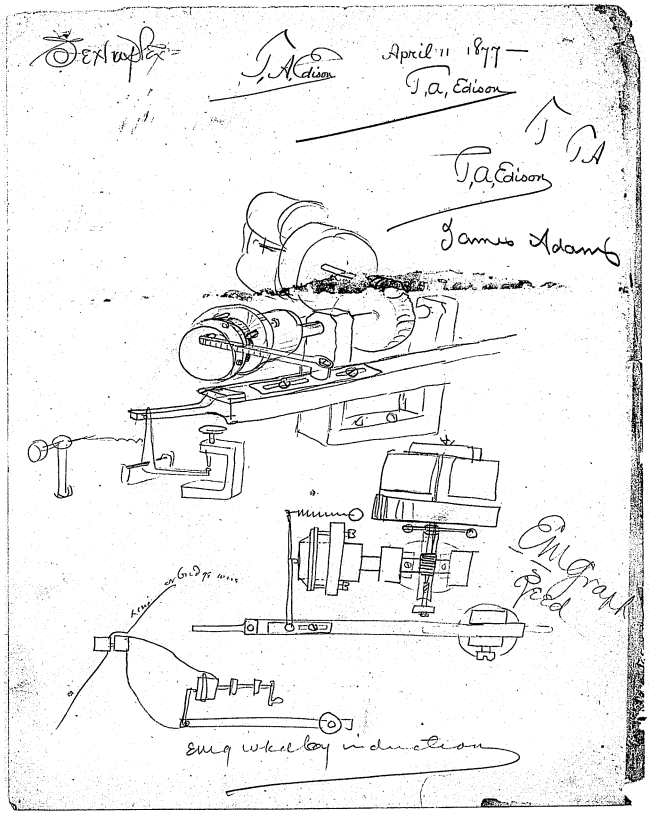
April 10 1877

Duplex

Thomas A. Edison

James Adams

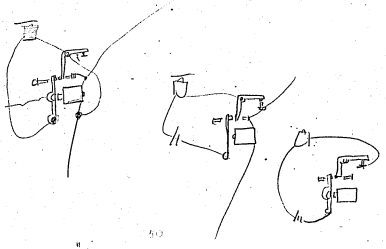



Example
T. A. Edison
April 11 1877
T. A. Edison
T. A. Edison
James Adams
Emg Graph Reed
Emg wheel key induction

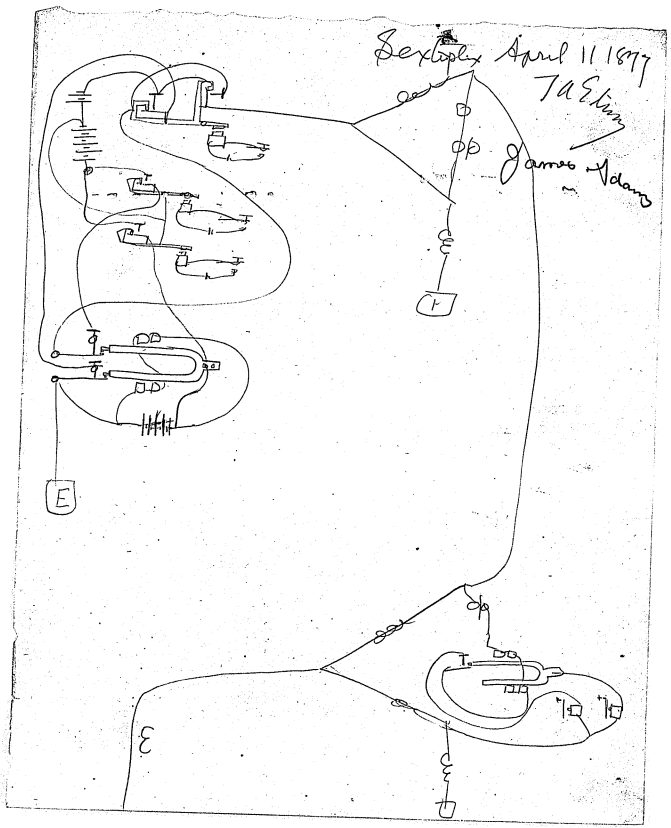
Sextuplex April 11 1877.

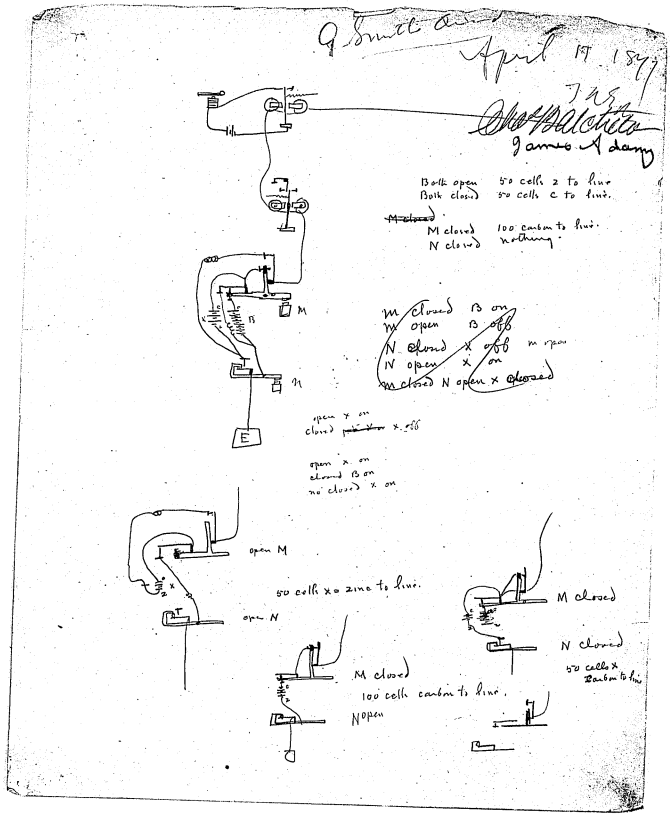
T A Edison

James Adams



I propose to send with 100 cells Positive reversed by Embosser on 1 Pivot, send with 100 cells Neg reversed on other line, when Both Batteries on 1 Key Kill Each other & no current reaches on a Distant line =


Sextuplex April 11 1877
T A Edison
James Adams
E


Q Switch
April 19. 1849
James Adams
Both open 50 cells z to line
Both closed 50 cells C to line.
M closed 100 cells carbon to line.
N closed nothing.
M closed B on
M open B off
N closed X off M open
N open X on
M closed N open X closed
open X on
closed B on
no closed X on
M
N
E
open M
50 cells x0 zinc to line.
open N
M closed
N closed
50 cells x carbon to line
M closed
100 cells carbon to line.
N open

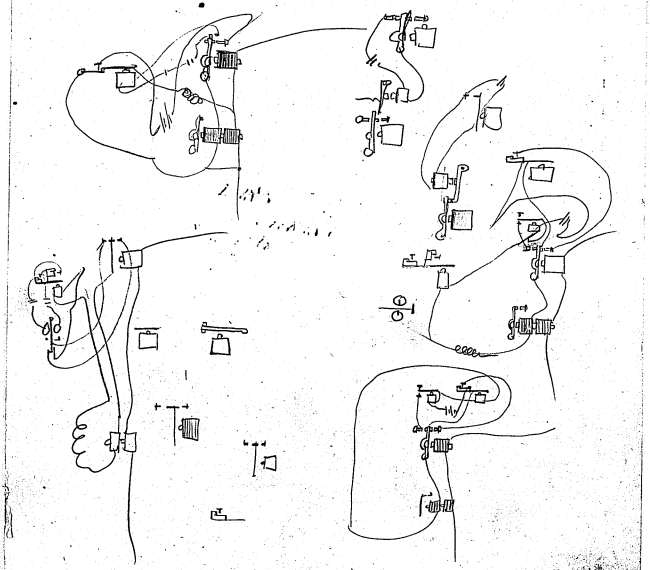
Sketch

April 12 1877

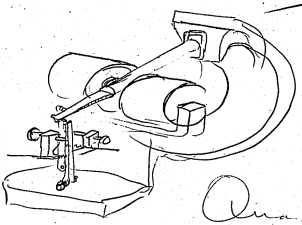
T.A. Edison

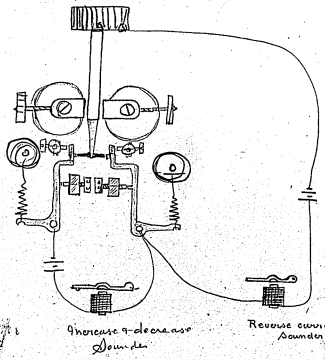
I think rawhide on a small platina diaphram would be best thing for Em. Graph - with Accoustic

James Adams



April 12 1877
T. A. Edison
James Adams
Chas Batchelor





18
54

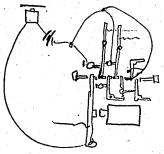
105.
18
20
50
213.

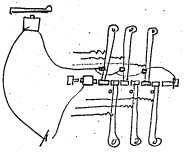
Detroit
Detroit
Detroit
Detroit
Detroit

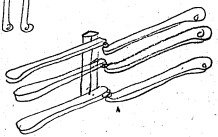
April 12 1877
Jardine

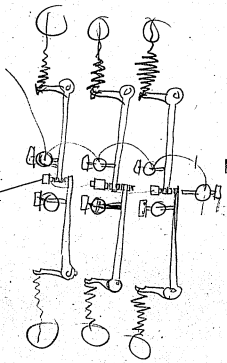
Increase of dec Quad of Sextuplex

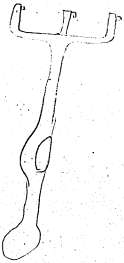
James Adams











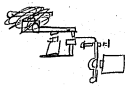
Duplex

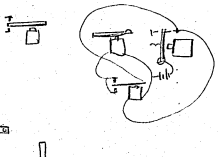
April 12. 1874.

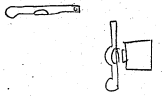
T. A. Edison

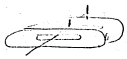
James Adams

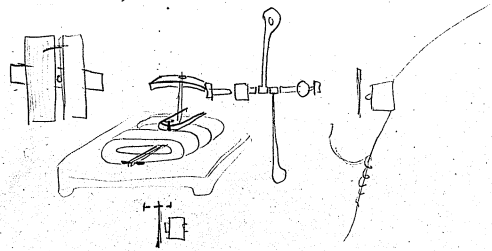
Chas. Batchelor

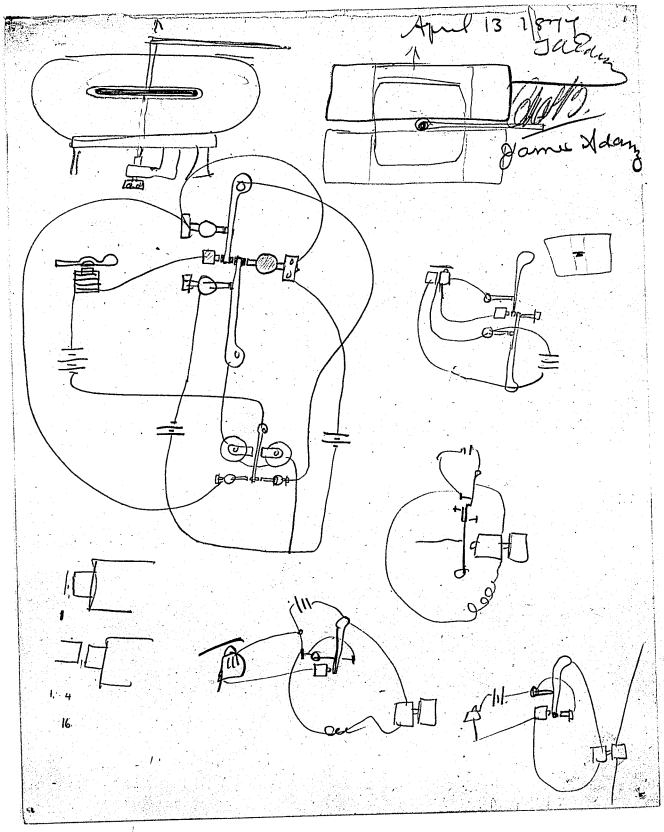








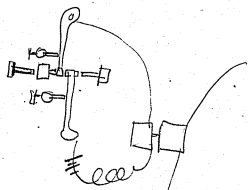



April 13 1877
James Adams
1. 4
16.

D

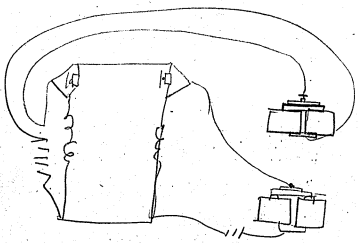
April 13 1877
J. A. Edison

James Adams
Chas Batchelor

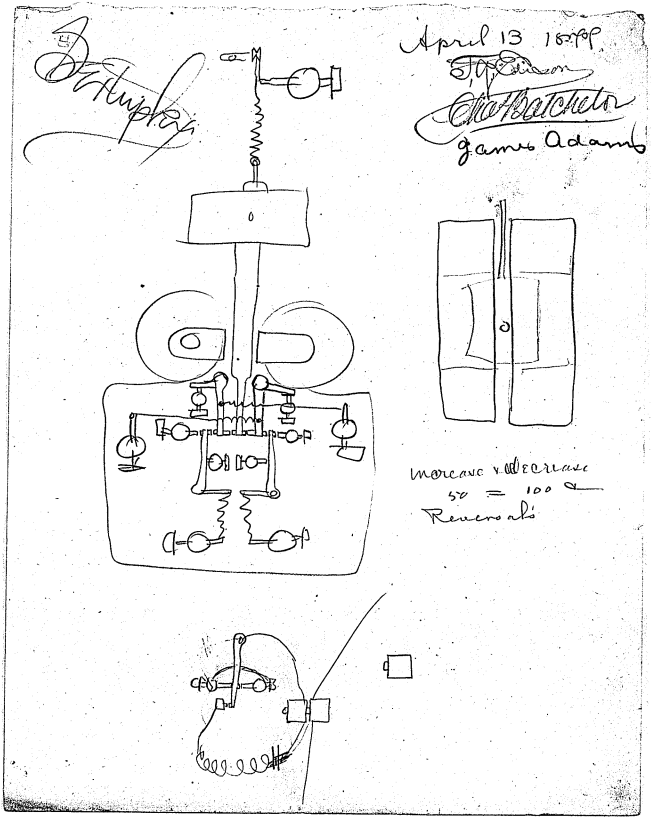


Sir Charles

April 16 1877
J. A. Edison



Boston
Boston
Boston


April 13 1897
Witnesses
James Adams
Increase
50 = 100
Reverse

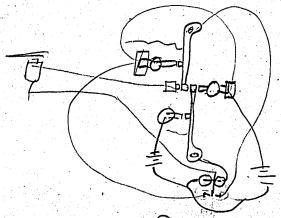
Duplex

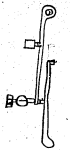
April 13 1877

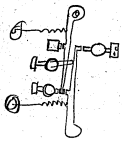
T A Edison

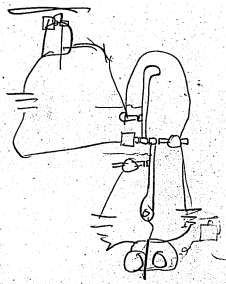
Charles Batchelor

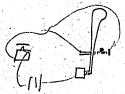
James Adams











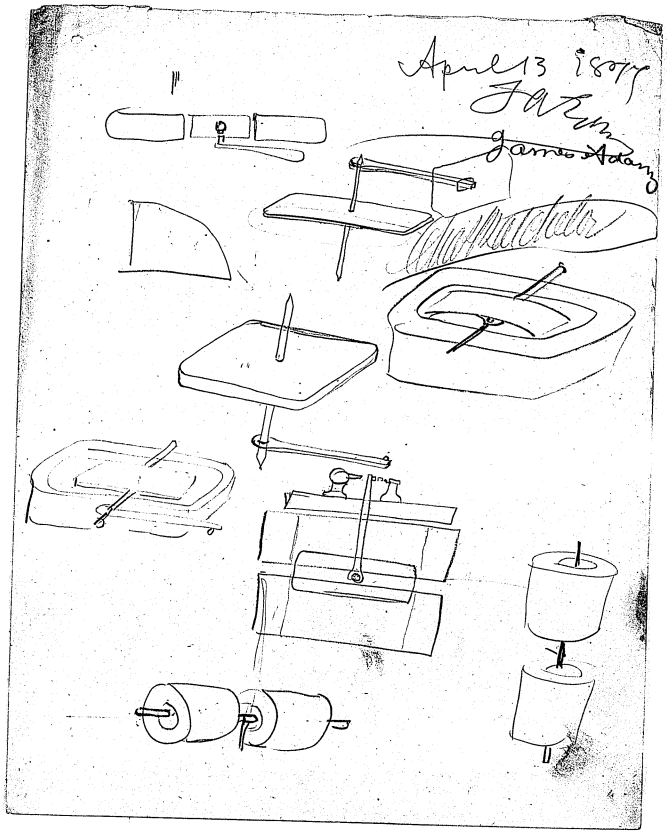
50.

50.

100

125

50.

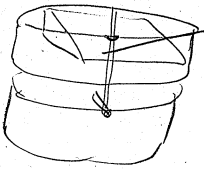

April 13 1877
James Adams

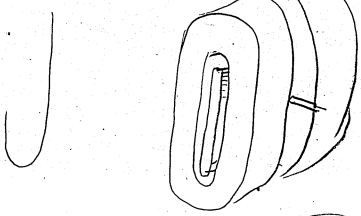
April 13 1897

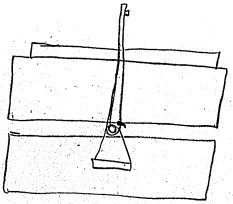
Edison

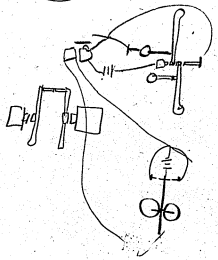
Phonograph

James Adams





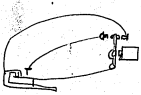


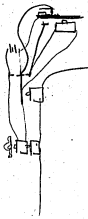


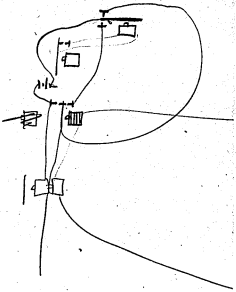
Sketch

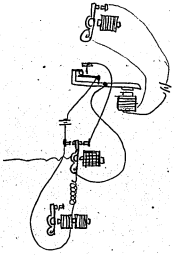
April 13 1877.
T A Edison

James Adams
Chatterton









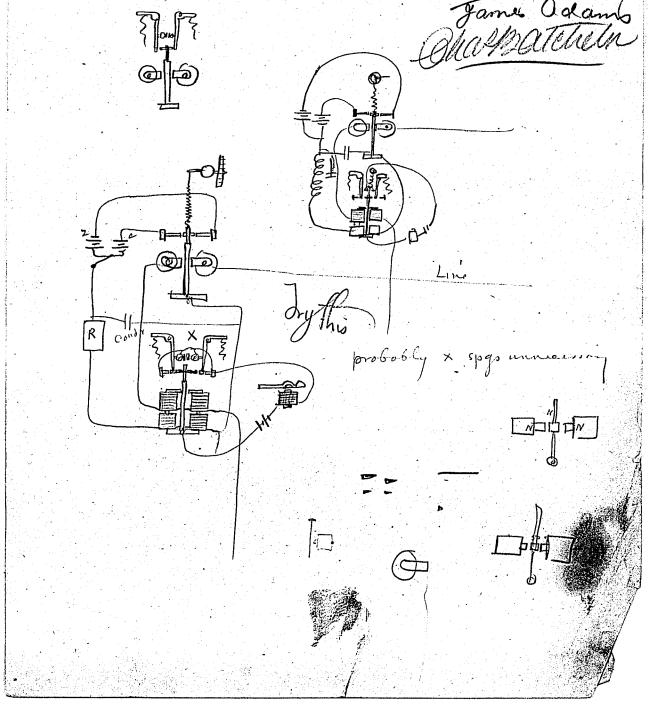
Duplex

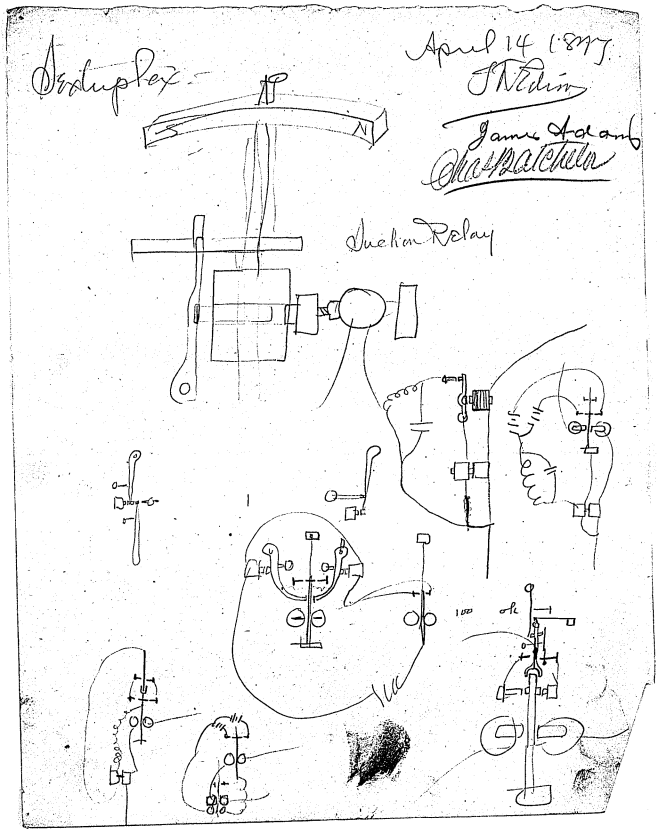
April 14 1877

Edison

James Adams

Quadruplex

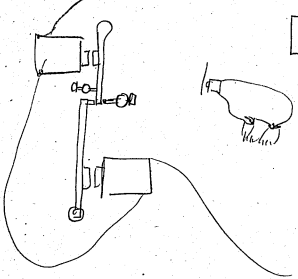


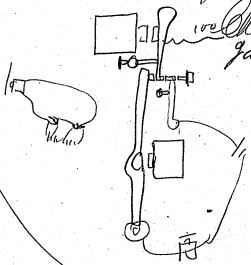

Duplex
April 14 1877
J. N. Edison
James Adams
Duplicator
Induction Relay

Dentuplex

April 14 1847

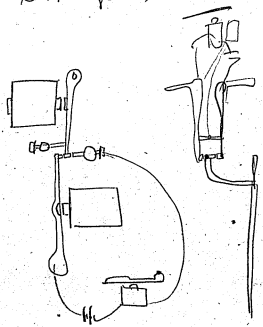
Inventor Charles Peters
James Adams

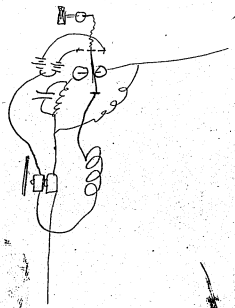


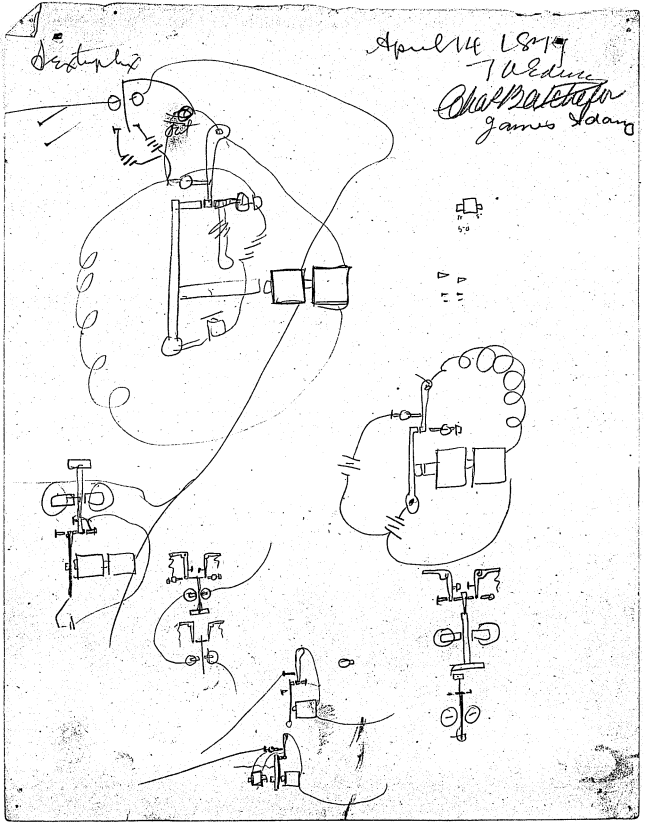


Dentuplex

April 15 1847
Inventor





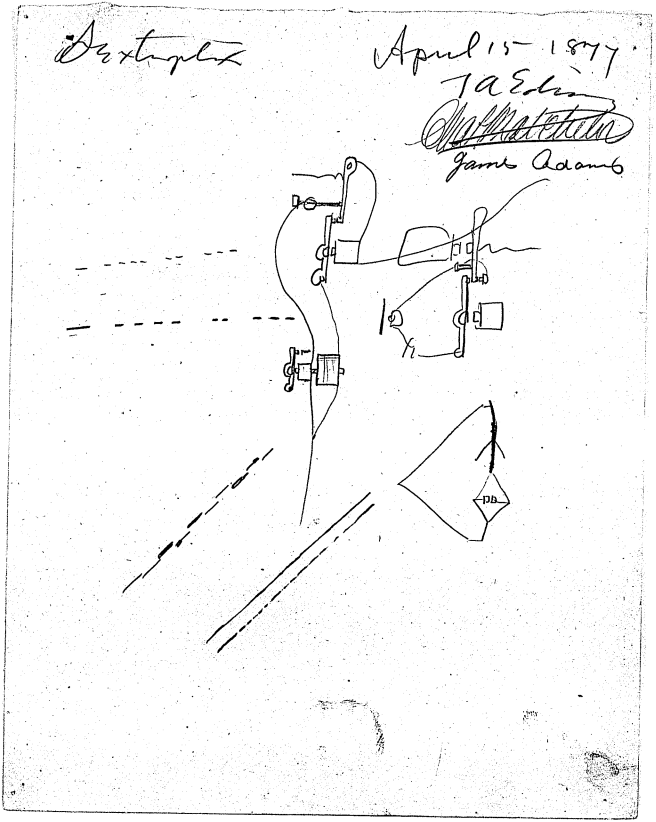

Stereoptic
April 14 1897
To Edison
Chas Batchelor
James Adams

Duplex

April 15 1877.

T A Edison

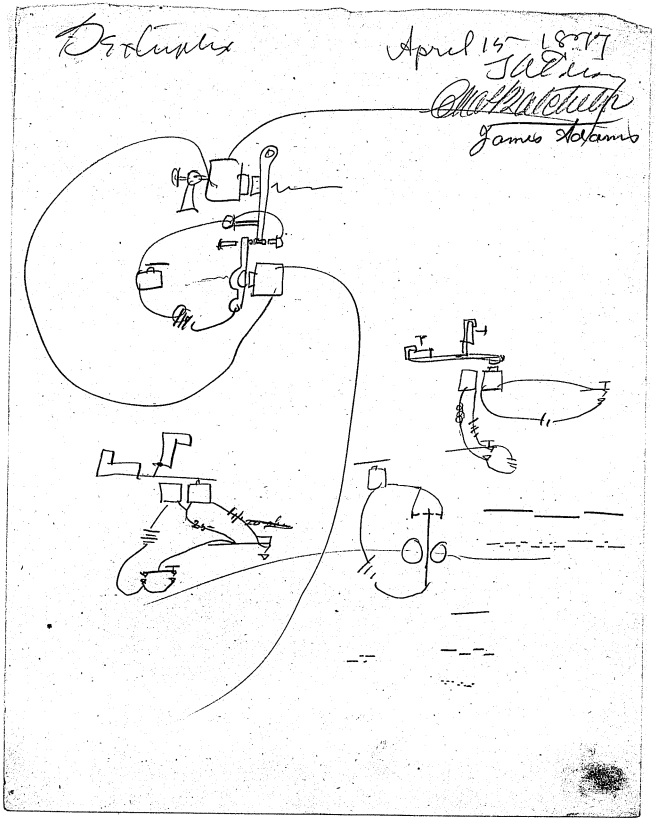
James Adams

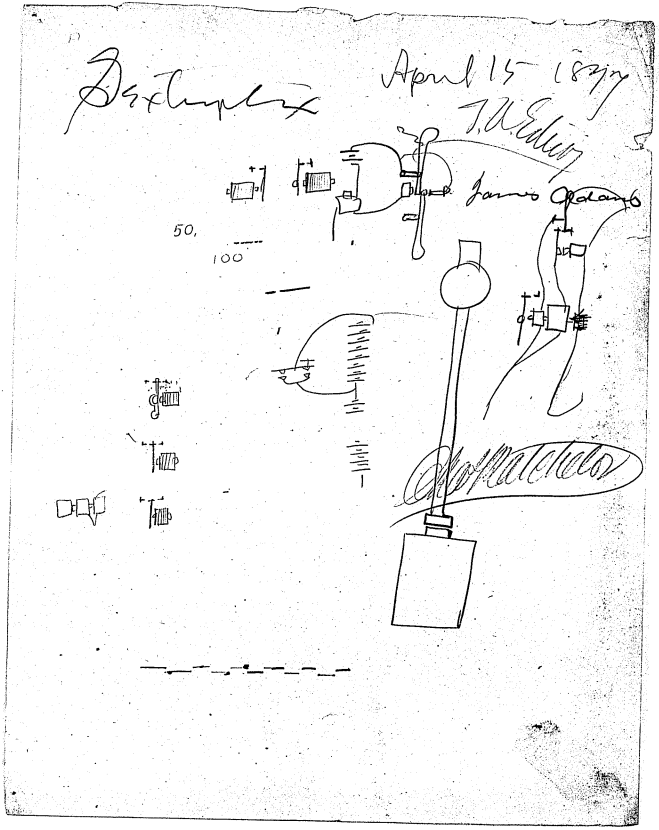


Exhibits

April 15 1877

James Adams




Dextrophos
April 15 1897
T. W. Edison
James Ogden
50,
100

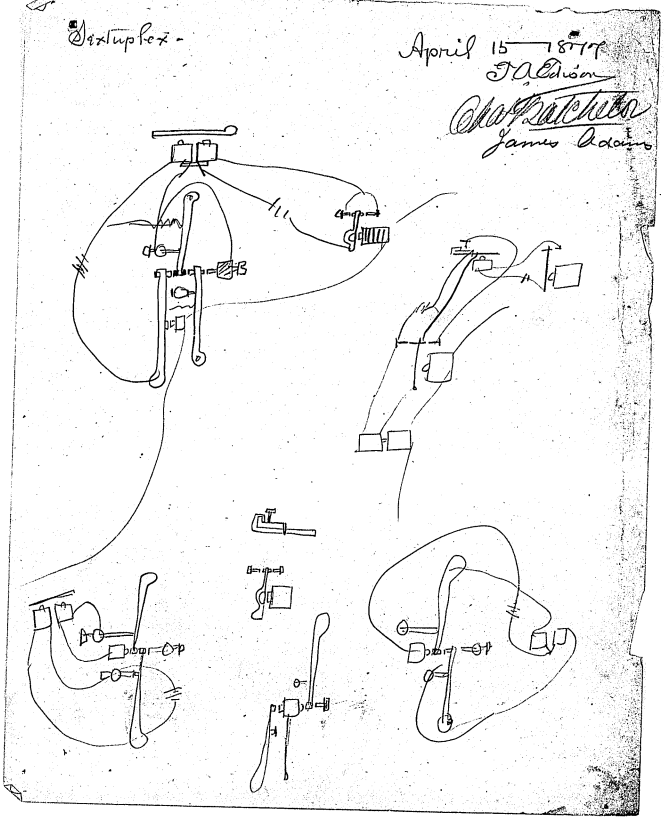
Dextroplex -

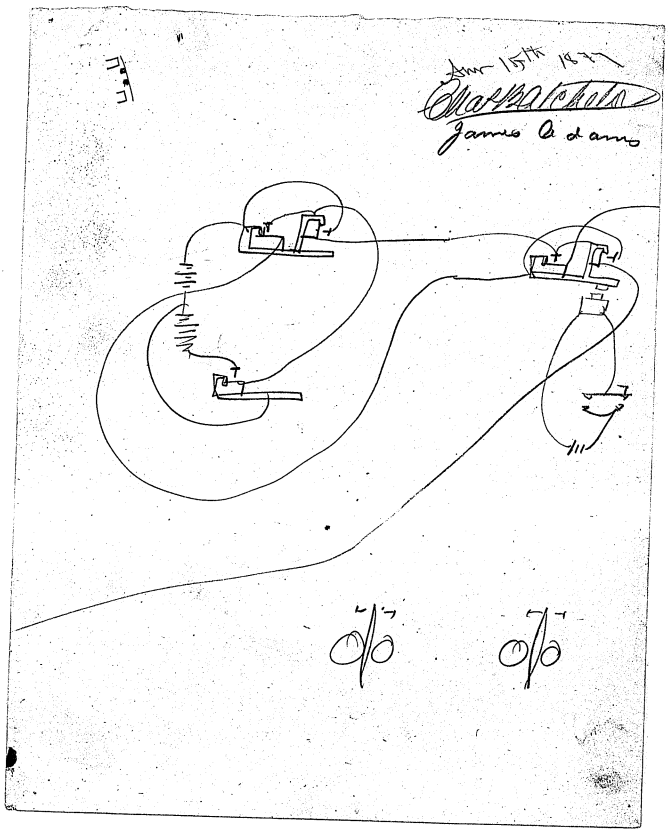
April 15 1877

T A Edison

Chas. Batchelor

James Adams




June 15th 1897
Marshall
James A. Adams

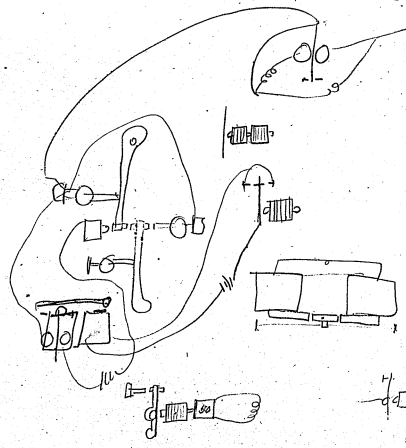
Dextraphy

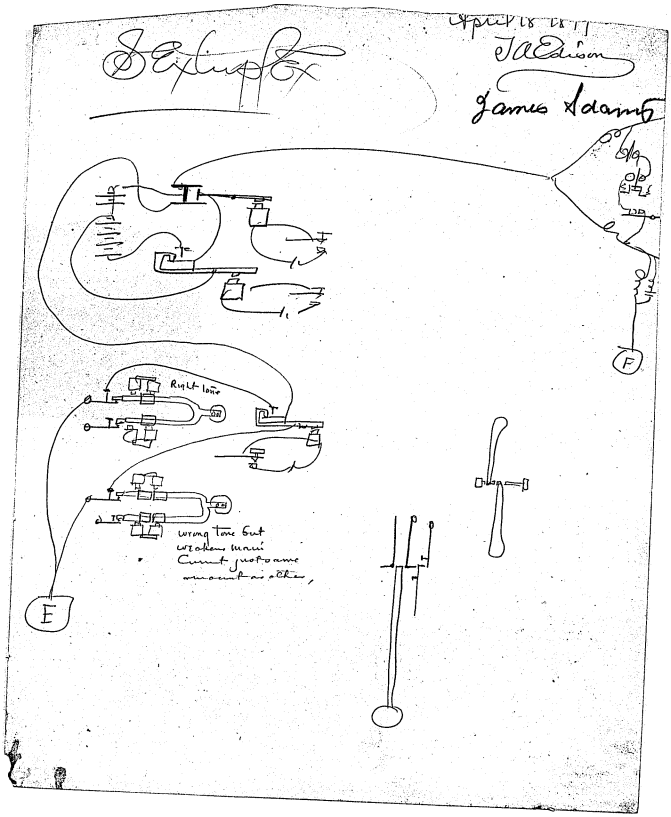
April 15 1897

T.A. Edison

James Adams

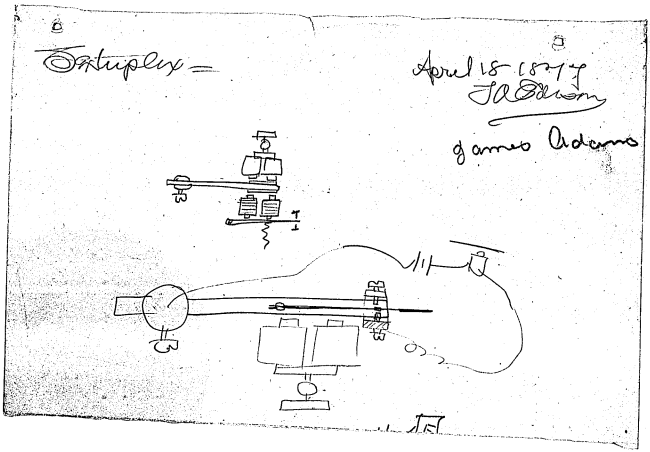
Chas. Batchelor

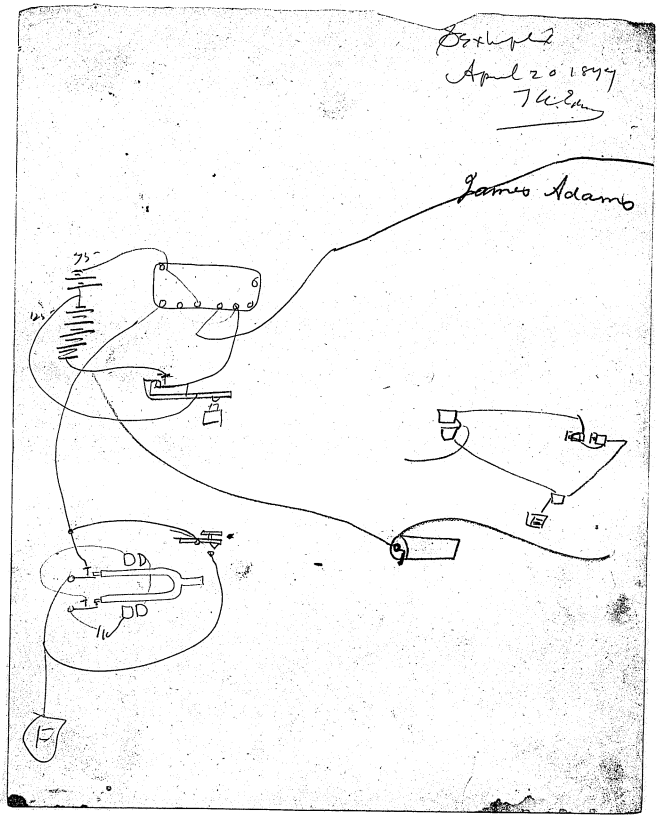



Right tone
wrong tone but
works much
Current just same
F
E

Sextuplex —

April 15 1917
J. A. Gibson
James Adams



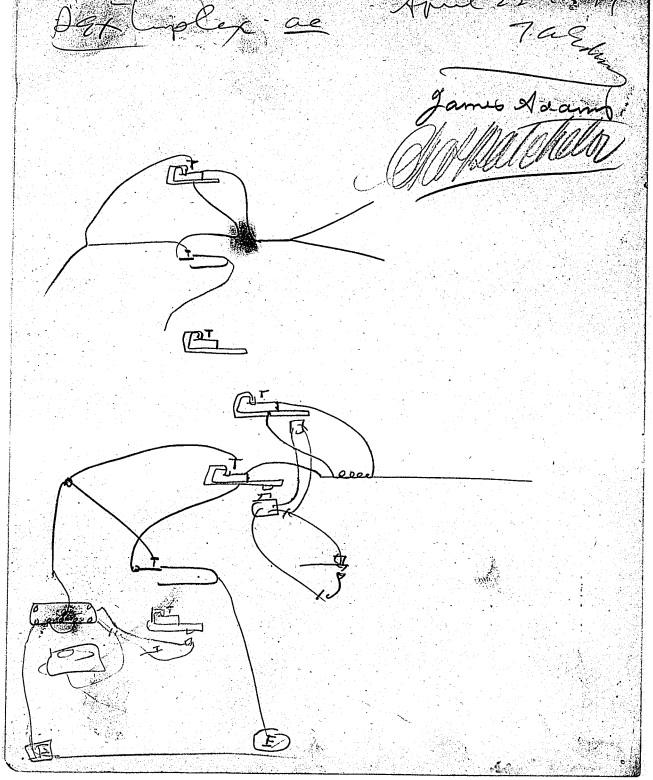

Sketch
April 20 1894
James Adams
75
DD
DD

Detail of ac

April 22 1879

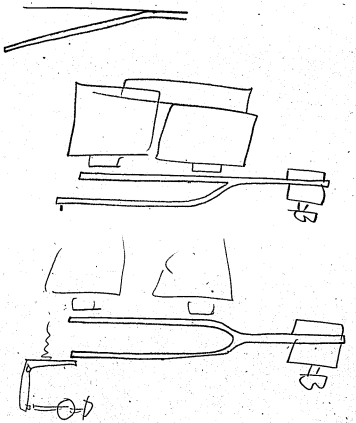
T. A. Edison

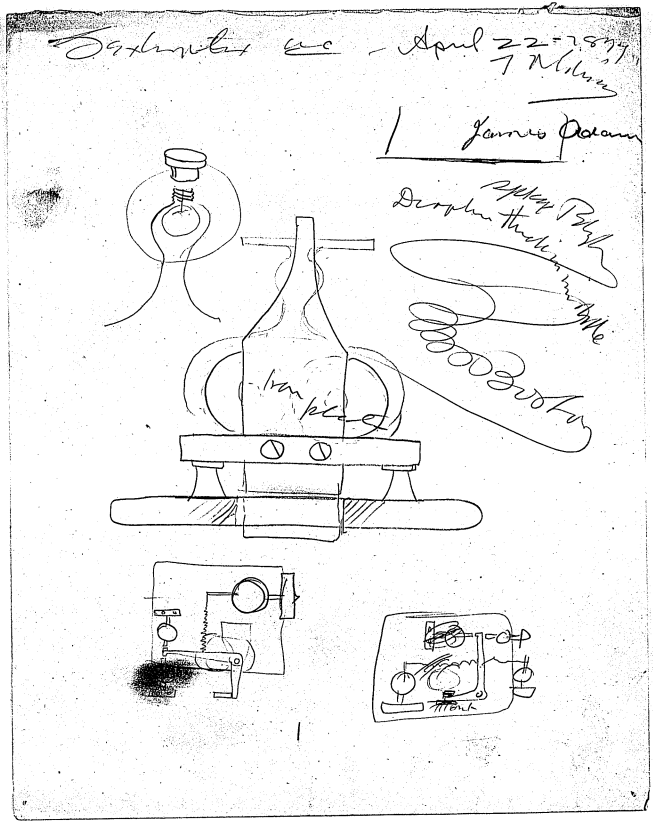
James Adams



April 22 1873

James adams



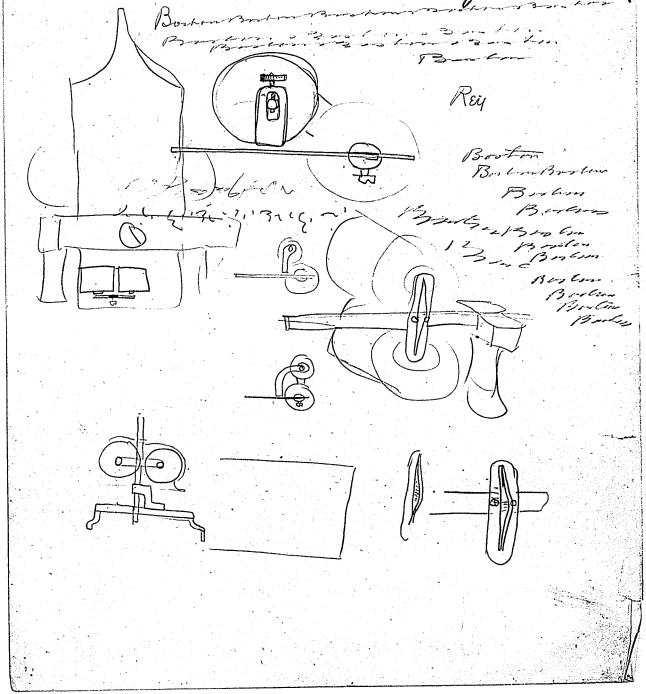


Southampton

April 22 1877

T A Edison

James Adams

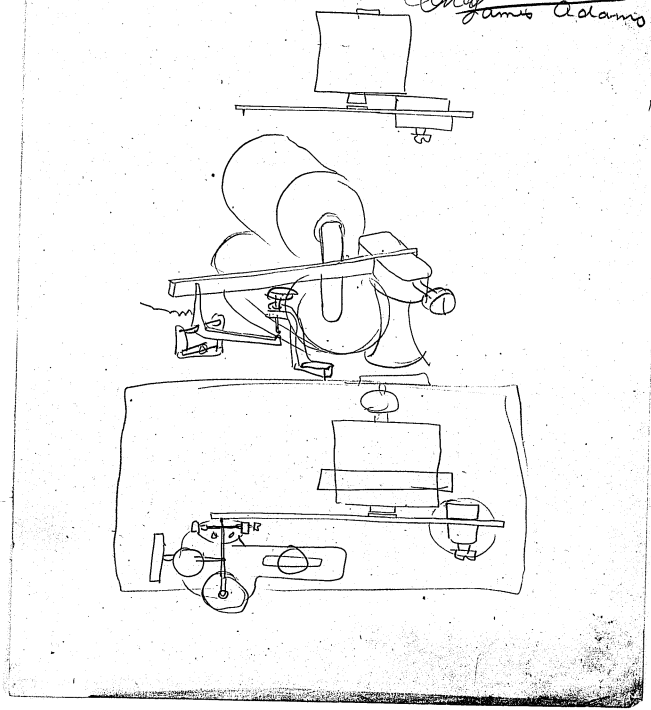


Baxlumbus

April 22 1877

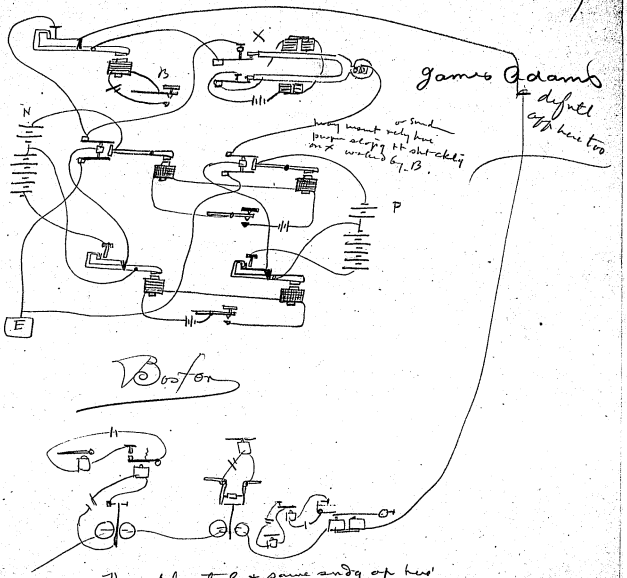
Witnesses

James Adams



Duplex

April 23 1874
TA Edison

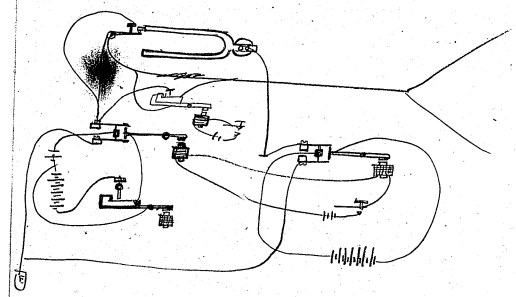


These differential + same sendg op here

Duplex -

April 23 1877
J. A. Edison

James Adams



April 24 1874

James Adams

Thomas A. Edison

Thompson

Boston Boston

Boston

Boston

Boston

Boston Boston Boston

Boston

Union

Sextuplex

April 24. 1877

T. A. Edison

James Adams

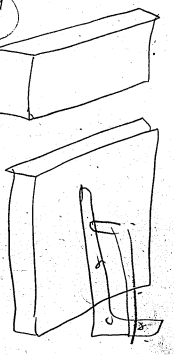
Morning

Rey Reyn

Thas A. Edison

Thas A. Edison

Thas A. Edison

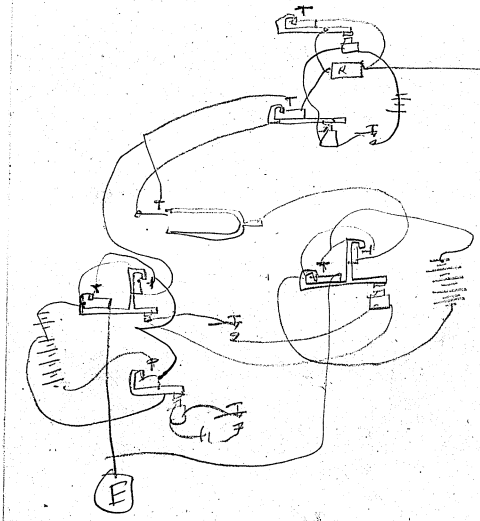


Sextuplex

April 24 1879

T A Edison

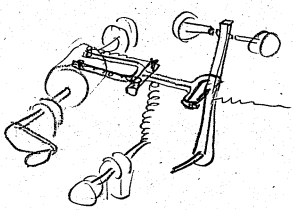
James Adams

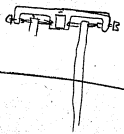


Septuplex
Emig app

April 27 1877
J A Edison

James Adams





Talking Tel

1 Lamp black
1 Bone Black
Bituminous Coal
Anthracite Coal
1 Black oxide Manganese
½ Black oxide Manganese & Plumbago -
Iodide Copper - small disk
Peroxide of Iron =
Sesquioxide of Iron

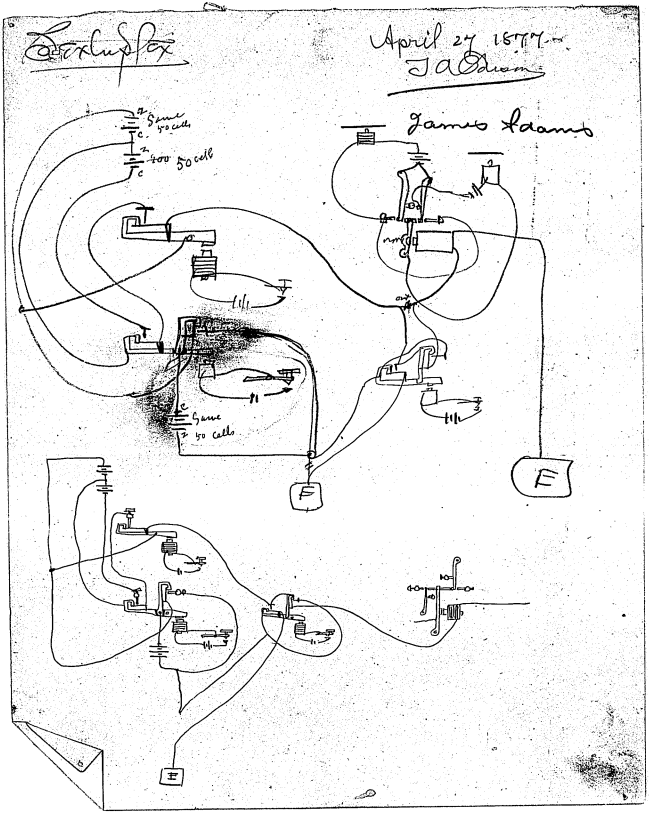
Protoxide Nickel,
Bisulphuret of Tin,
Chromate Copper
Paris green,

Duplex

April 24 1877.

J A Adams

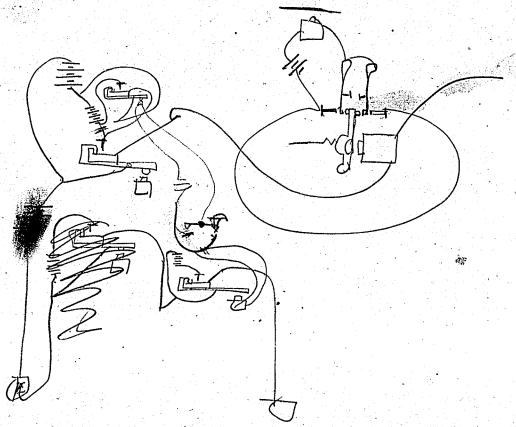
James Adams



Duplex

April 27, 1877 =

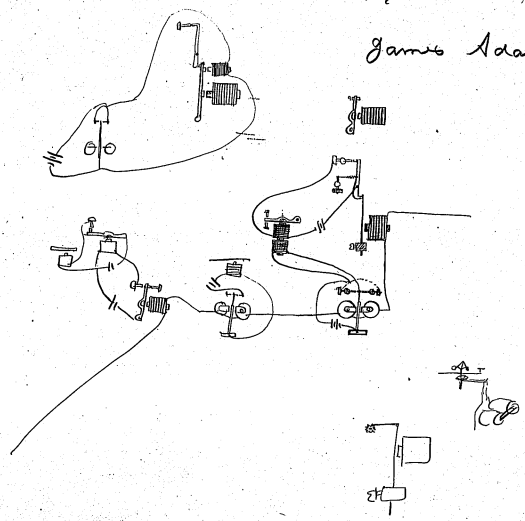
James Adams



Alexander Graham Bell

April 28 1877
Edison

James Adams

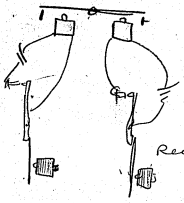


Sextuplex

April 28 1877

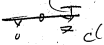
J. A. Adams

James Adams

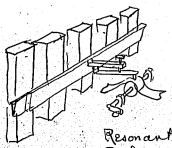


156 vib

178, vibs



Open 156 or thereabouts



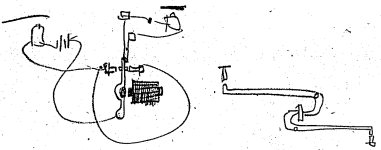
Resonant boxes with diff Column and Eng

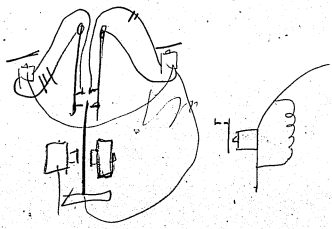
// W Boston

April 25 1899

T. A. Edison

James Adams

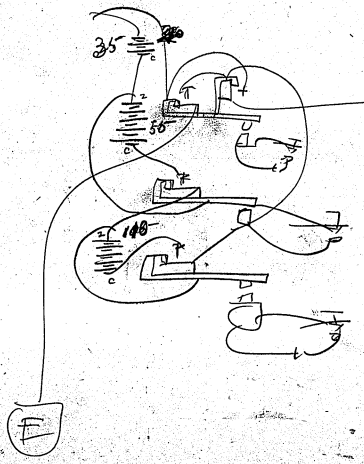




Duplex

April 29 (copy)

James Adams

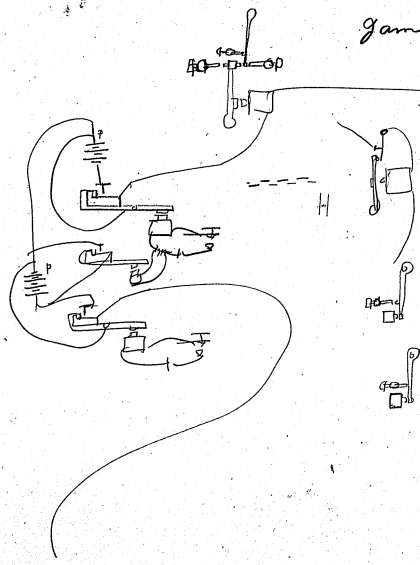


Duplex

April 29 1875

T.A. Edison

James Adams



Jan 3rd
James Adams

Plans of working 3 messages in the same direction for Duplex working.

1 Reversals
2 Increase +
3 Increase +

Polarized relay 50 perm
Common " 75- mic
Common " 150 "

Reversals
Increase +
Acoustic -

Polarized relay 75 perm
Com " 100 mic
Acoustic " Overall Total

Reversals
Very small reversals of the 1st long reversals
Increase +

Polarized relay 50 perm
" or acoustic same
Com Relay

1 Increase + d
2 Increase + d
3 Acoustic

4 relay { Com relay / Com relay / Acoustic, 50 perm

3 increases 50 - 100 - 200 -

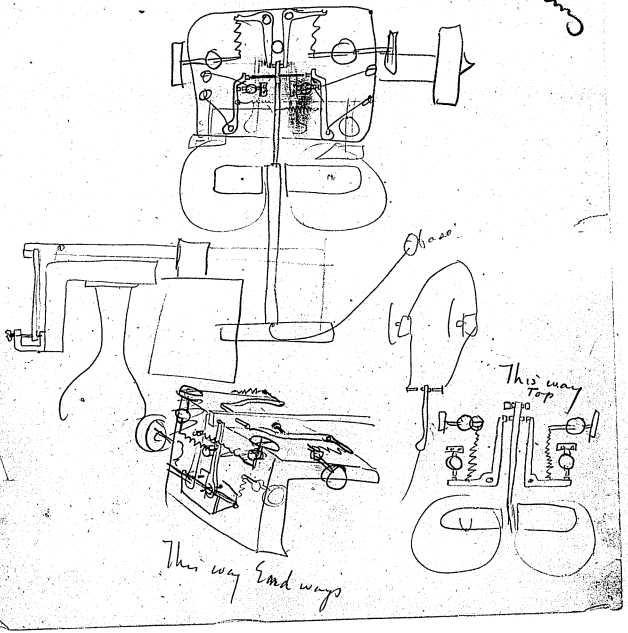
Specification

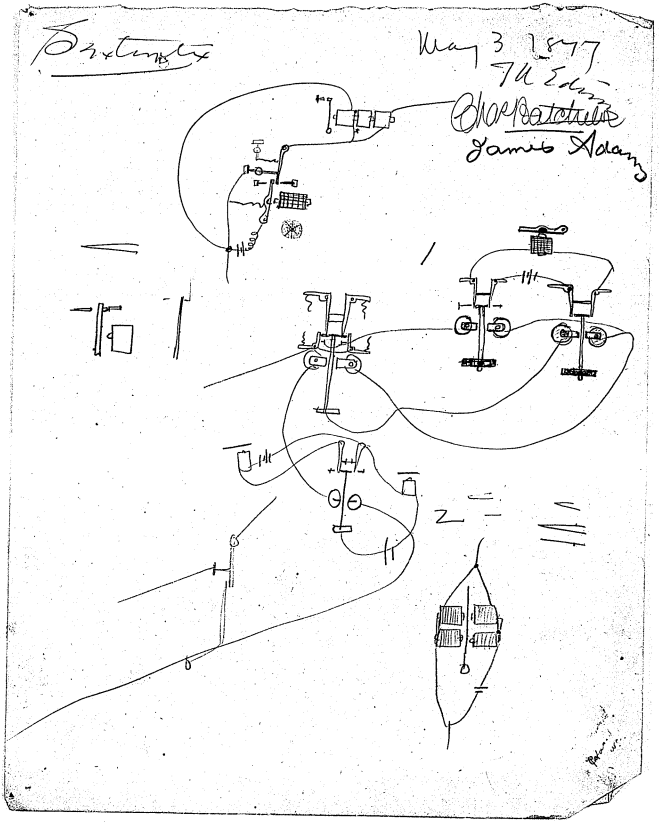
May 3 1877

J. C. Talcott

Chas. Richardson

James Adams



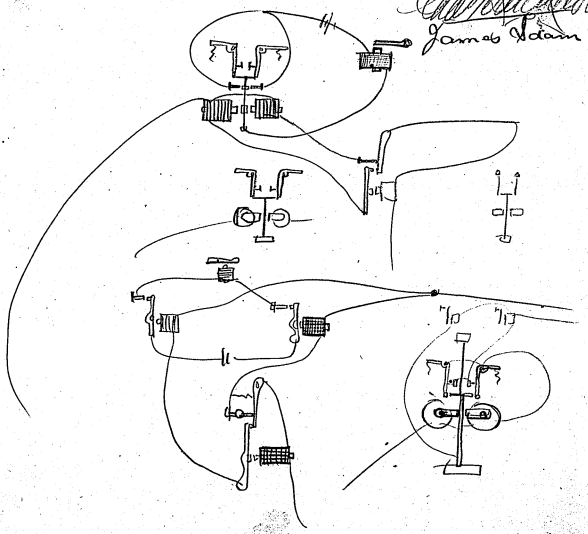

May 3 1877
Electric Motor
James Adams

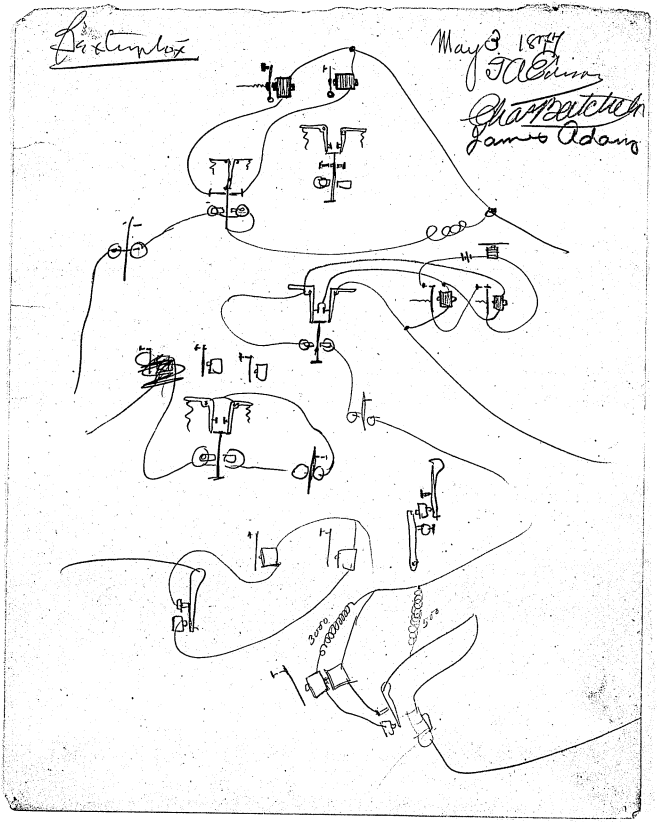
Sextuplex

May 3rd 1877

Thos A Edison

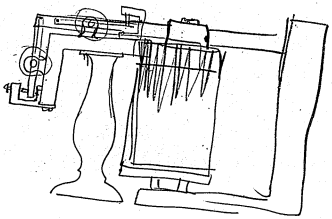
Jamab Adam




May 3 1874
James Adams

Satisfactory

May 3 1847.
J. A. Adams
Chas. Batchelder
James Adams



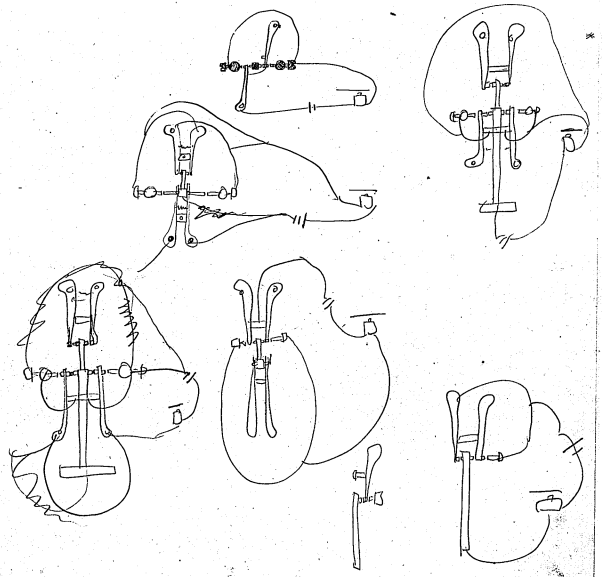
Sextuplex

May 6 1877

T. A. Adams

Chas Batchelder

James Adams

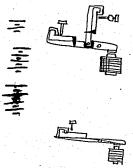


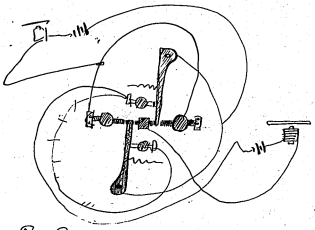
May 6 1847

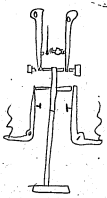
J. A. Edwin

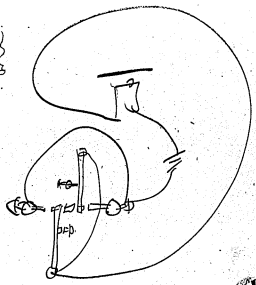
Charles Satchell

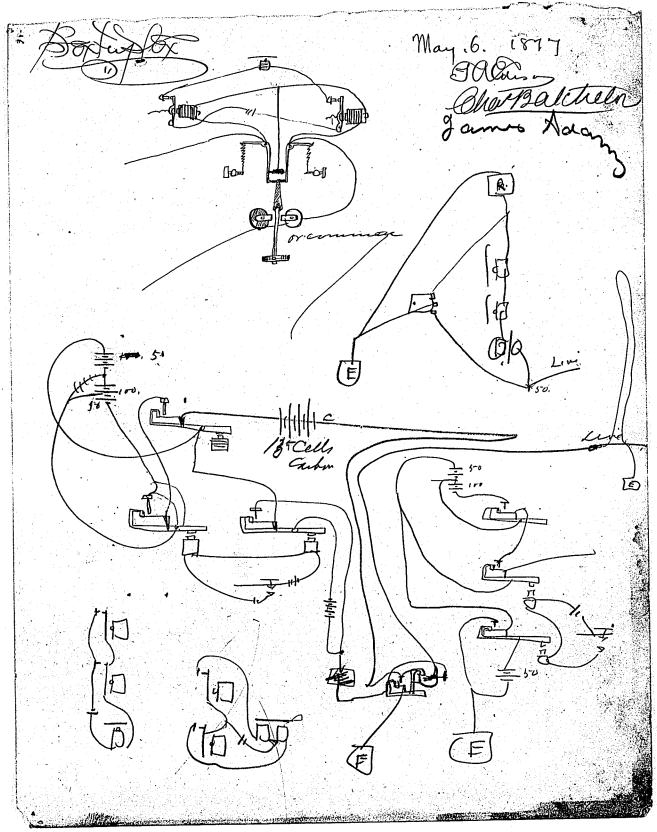
James Adams










Box Key
May. 6. 1877
Chas Batchelder
James Adams
Lin
125 Cells
Carbon

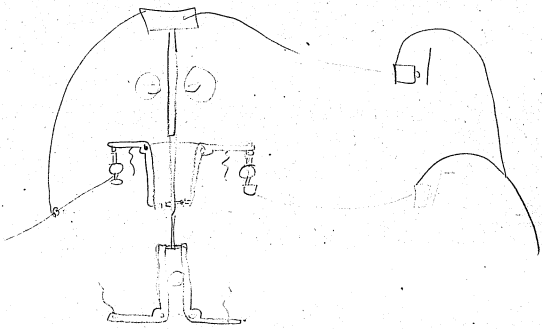
Baptismal Font

May 6 1877

Date

Draughtsman

James Adams



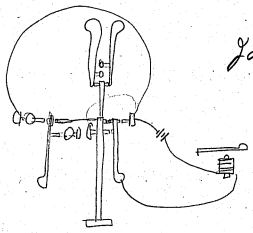
Dextruplex

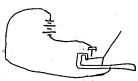
May 6 1879

T A Edison

Chas Batchelor

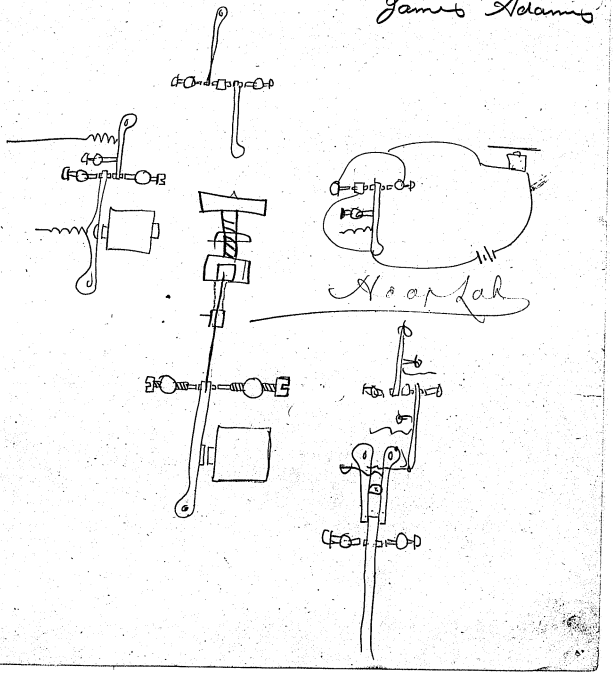
James Adams





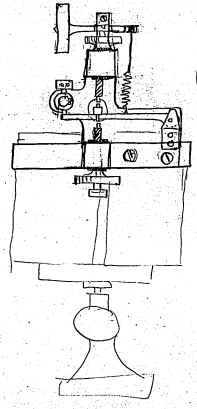
Duplex

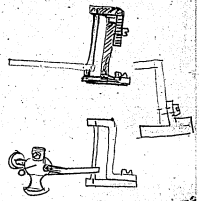
May 8. 1877
J.A. Edison
Chas. Batchelor
James Adams

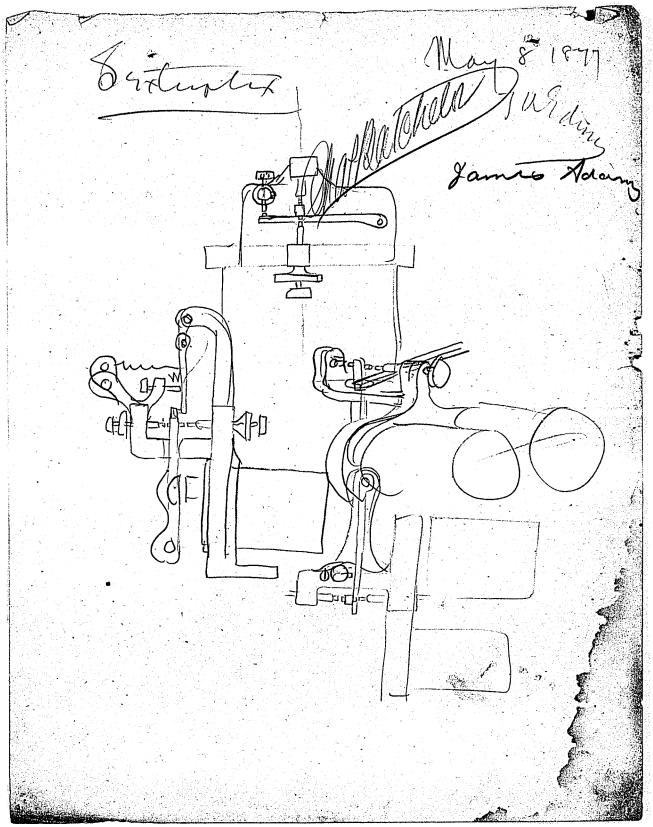


May 8th 1877

James Adams

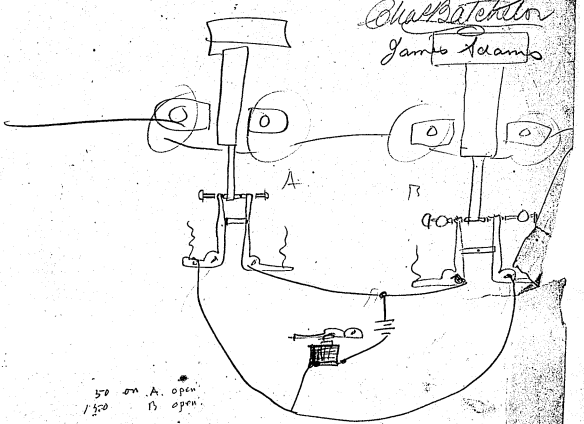





Sketch
May 8th 1877
U.S. Navy
James Adams

Sketch.

May 8th 1877.
J. A. Edison
Charles Batchelor
James Adams

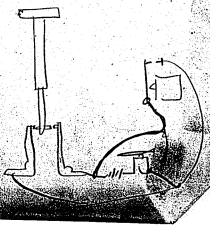


50 on A open
150 B open
50 off

50 off A open
150 on B open

50 on A open
150 on B Closed

off on A Closed
150 on B open



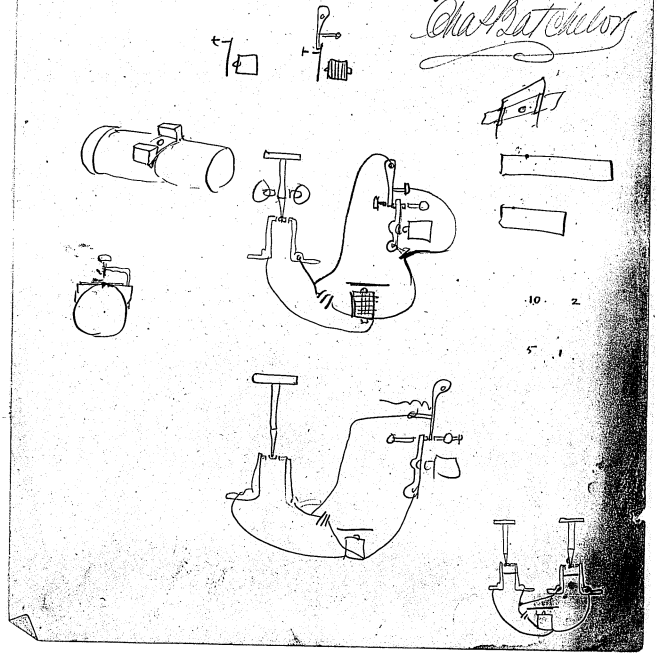
Santuplex =

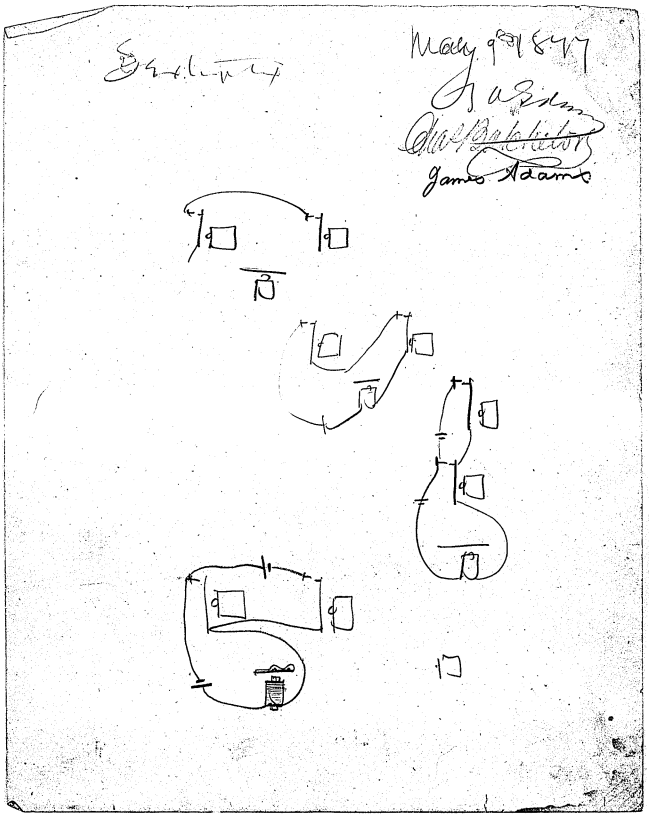
May 9 1874

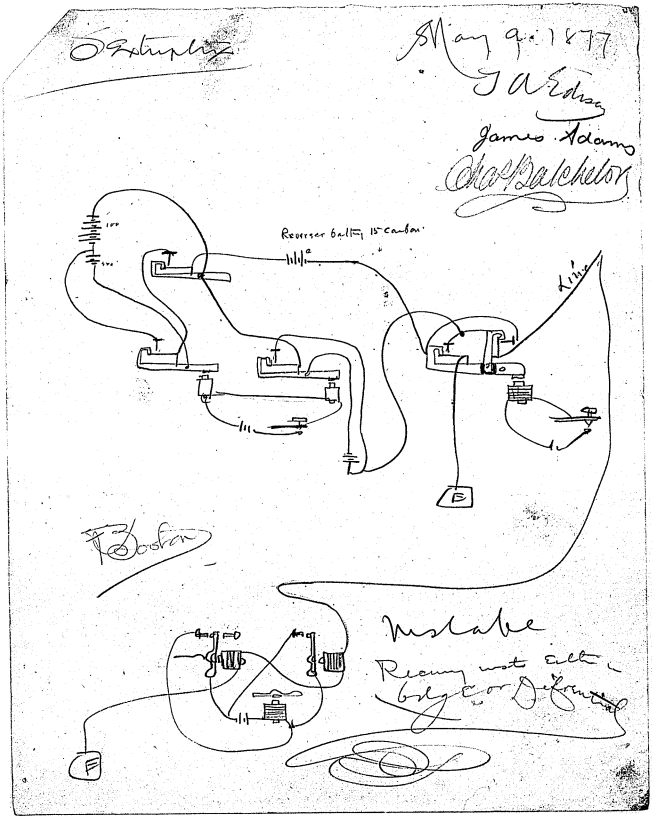
J. H. Eaton

James Adams

Chas Bartholomew

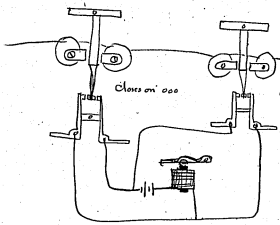


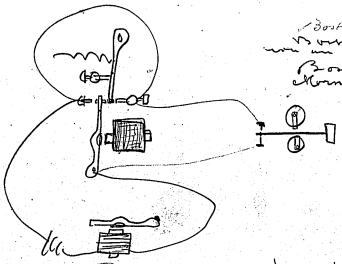

Mary 9th 1847
James Adams


Reverser battery 15 cells
Mistake

Sextuplex. May 9 1877.

76
Sextuplex
1877
James Adams



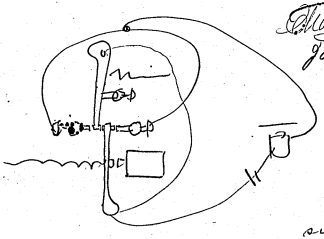


Boston Boston
Boston
Boston
Morning Boston

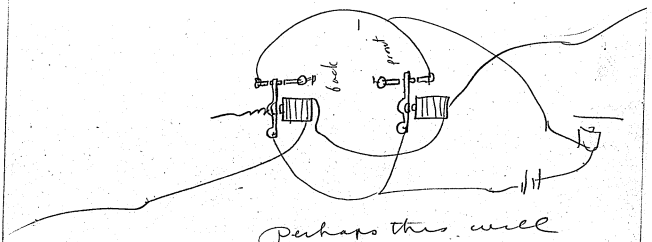
How is the motion of our tuning
fork glowworm aluminum by
this addition of your fork
!

Octuplex

May 9 1877
T A Davison
Chas B Tatem
James Adams



This works about same as the simple lever in front. perhaps not quite so well.



Perhaps this will replace -

Works well.
perhaps better than lever relay.

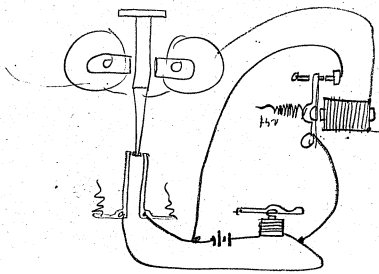
Duplex

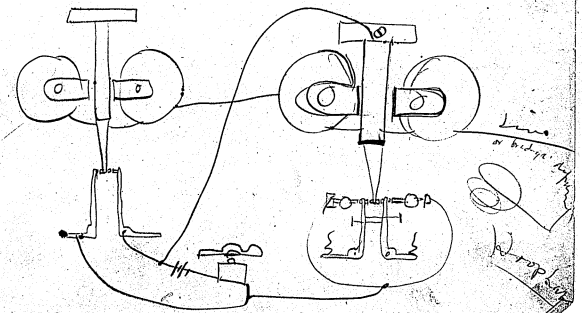
May 9. 1879

F A Gilmore

Chas Batchelor

James Adams





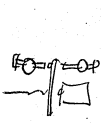
Sketches

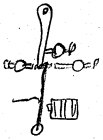
May 9 1877

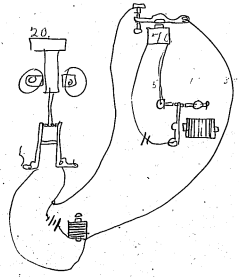
G. A. Cairns

James Adams

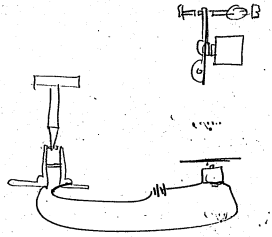
Edward Batchelder

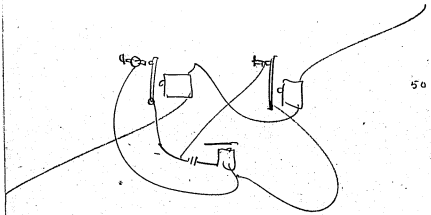


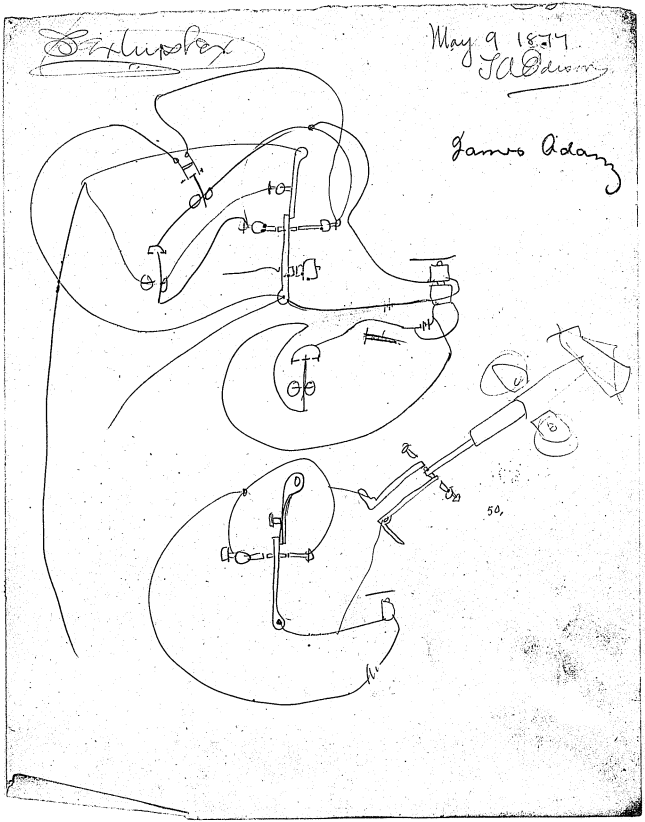




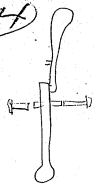
May 9 1877
T.A. Edison
Charles Batchelor
James Adams






Kinetoscope
May 9 1894
T.A. Edison
James Adams
50.

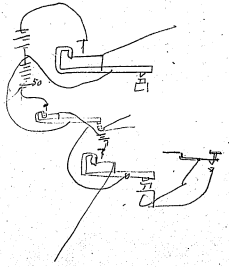
Telegraphy

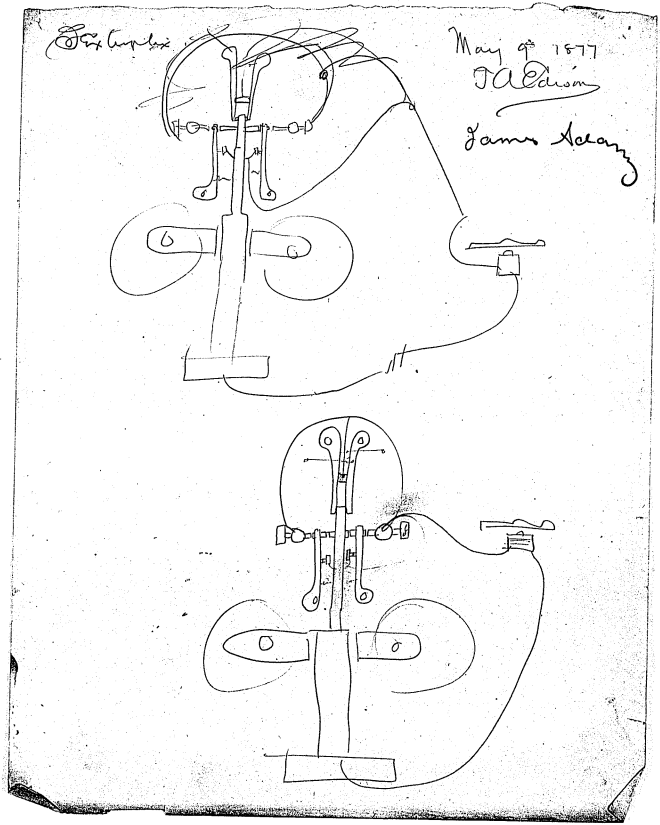


May 9 1877

J. Adams

James Adams




May 9th 1877
T A Edison
James Adams

25 -

50,

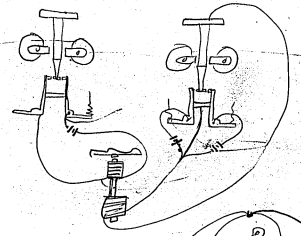
Sextuplex 25,

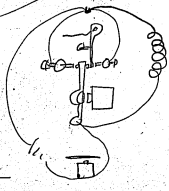
May 10 1877.

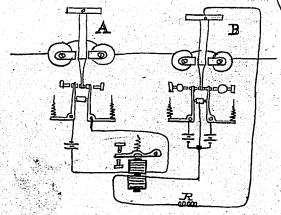
T. A. Edison

Chas. Batchelor

James Adams

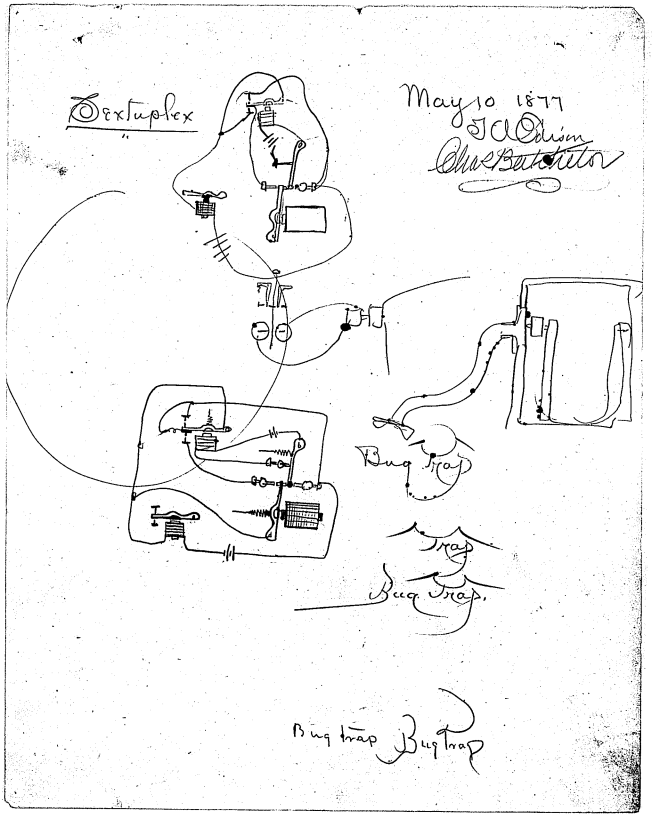






B may be of lower resistance than A

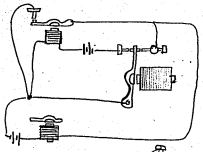
P


Sextuplex
May 10 1877
T A Edison
Bug Trap
Bug Trap
Bug Trap
Bug trap Bug Trap

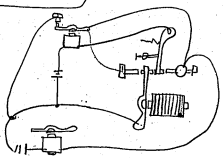
Sextuplex.

May 10 1877

T A Edison
Inventor
James Adams

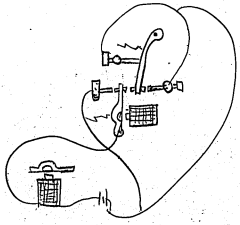


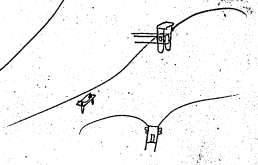
good bug trap for reversals for Quad



Bug trap for "Sexty"

1



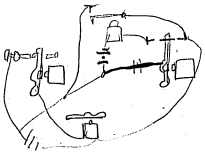


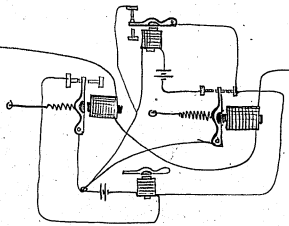
Quintuplex

May 10 1877

T. A. Edison

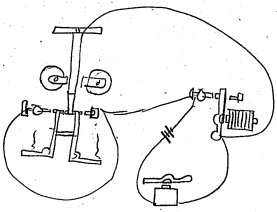
Chas. Batchelor

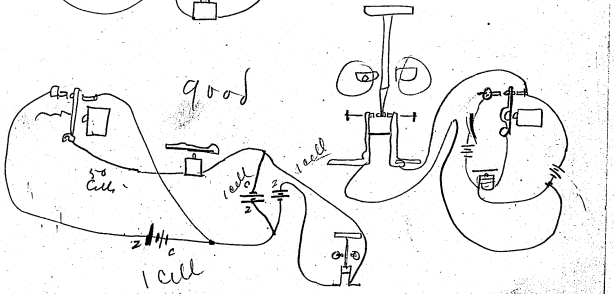




Duplex

May 10 1877
TA Edison
Chas Batchelor



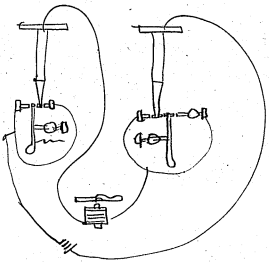


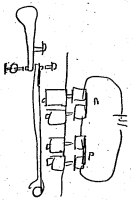
Sextuplex

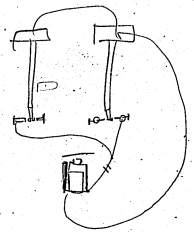
May 10 1877

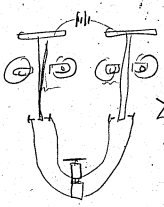
T.A. Edison

Chas. Batchelor









Duplex

May 10 1877

E. J. Adams

Margin for 8 with 50 cells
~~100~~ 25 to 75 Chas Batchelor

A. 50 ~~coulomb~~ of for A ~~100~~ 30 to 30,
50 Coulomb B " B closed 150, margin for 150, 100,

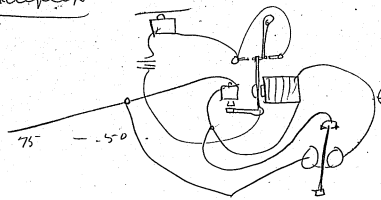
with A on or off. B works either with a 150 or a 100,
if B has on 30 cells,

100, 200,

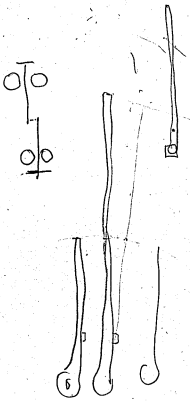
Sextuplex

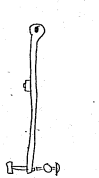
May 10
1877

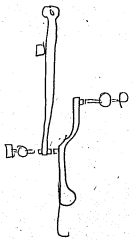
T A Edison
Chas Batchelor
James Adams



70. place 50 1st Transmitter
80 Bells, place 100,







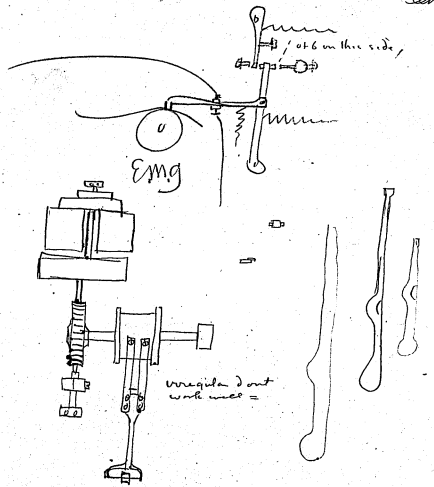
1

Sextuplex –

May 10 1877

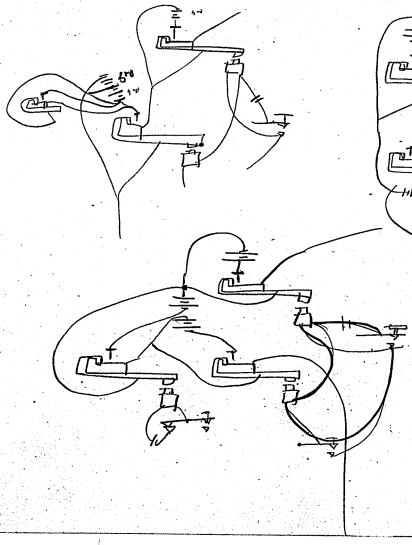
T A Edison

Chas Batchelor



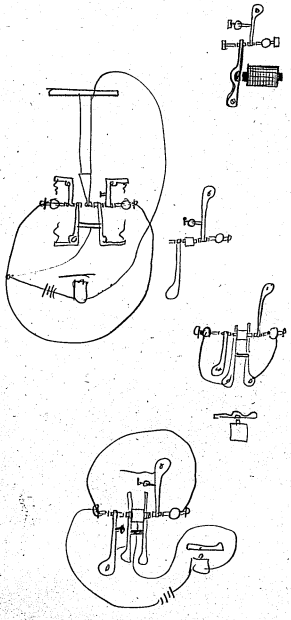
Sextuplex

March 10 1877
T. A. Edison
Charles Batchelor



Sextuplex

May 10 1877
J A Edison
Witness Batchelor



Will try this

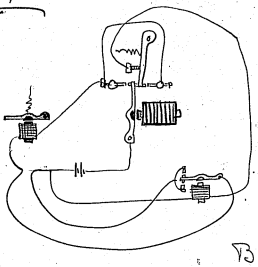
Of course this is good

Duplex

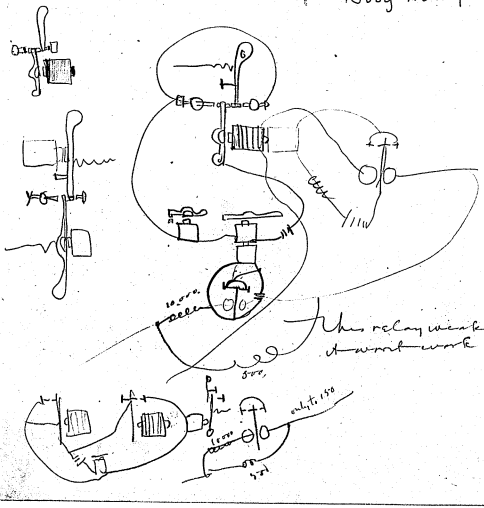
May 10th 1877

T. A. Edison

Electric Telegraphy

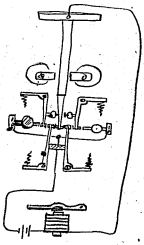


Boog Trahop

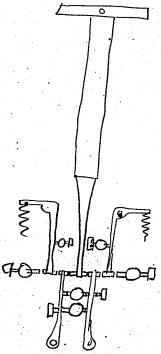


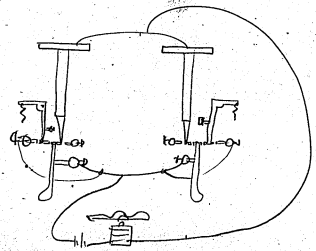
Dextuplex.

May 10 1877.
T. A. Edison
Chas Batchelor



Correct



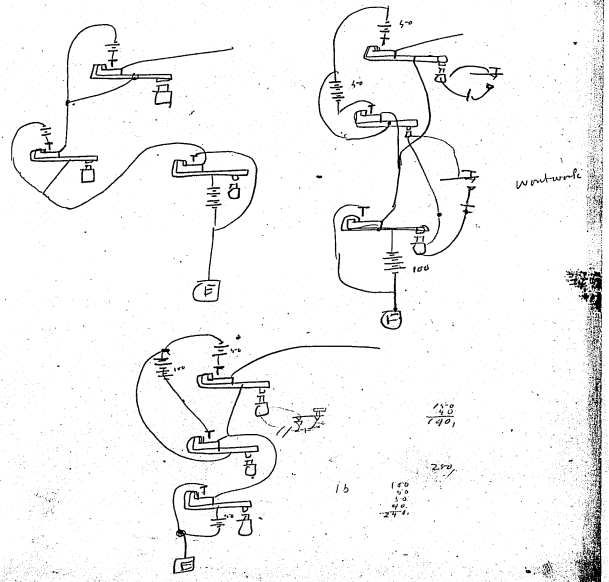


Sextuplex

May 10. 1877

Thos A Edison

Max Batchelor



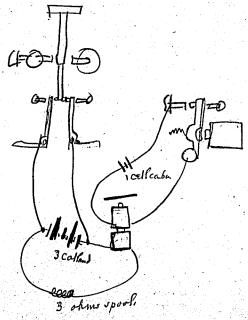
Boxty

May 14 1877

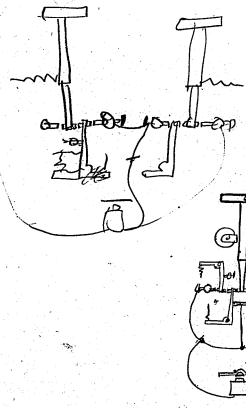
T A Edison

Chas B Batchelor

James Adams



Sketches May 11 1877

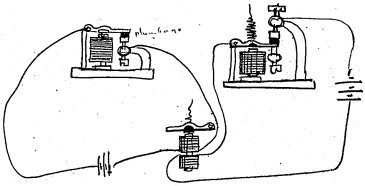


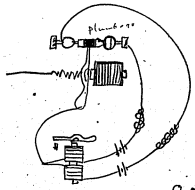
Dextruder

May 11 1877

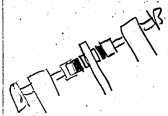
T. A. Edison

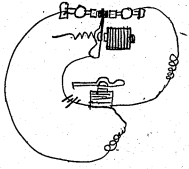
Chas. Batchelor





Treasure Belt



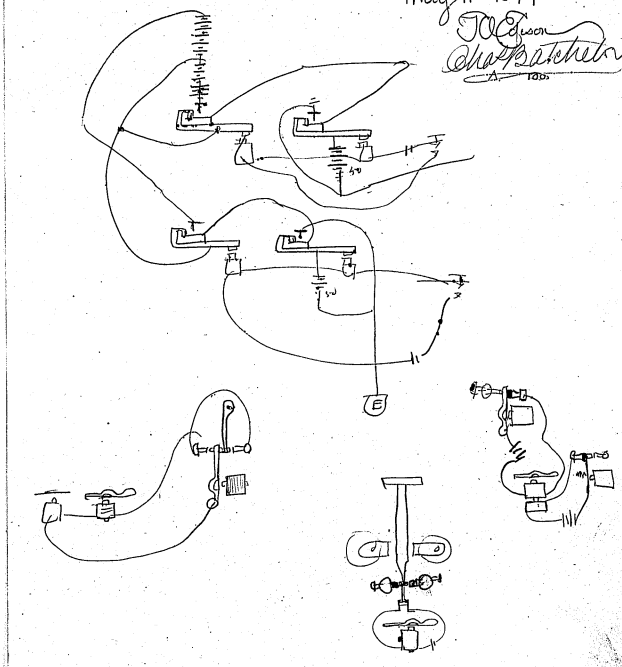


Duplex

May 11 1877

T. A. Edison

Chas. Batchelor

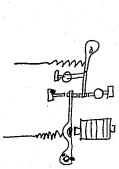


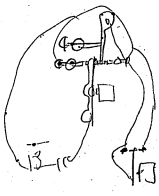
Duplex

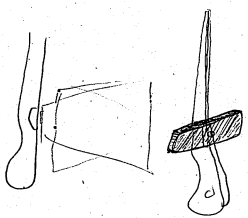
May 11 1877.

T A Edison

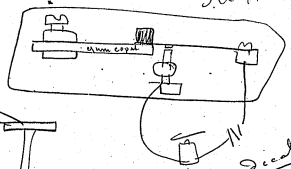
Chas Batchelor



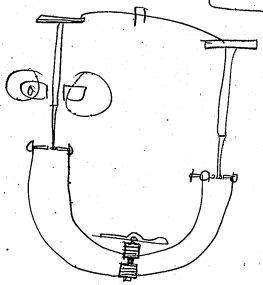


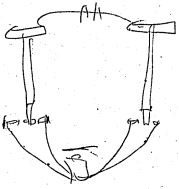


Baptisphere & Thermo indicator May 11 1877
J.A Fitch



Thermo indicator

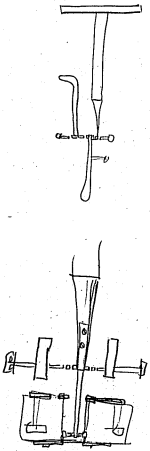




May 11 1877

J. A. Bohm

Chas. Batchelor

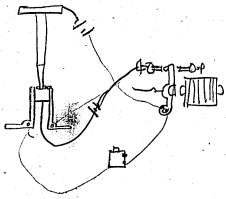


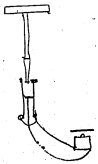
Sketch

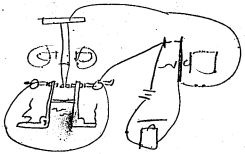
May 12 1877

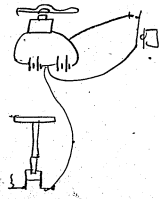
Jaeday

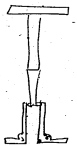
Chas Batchelder

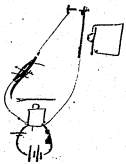






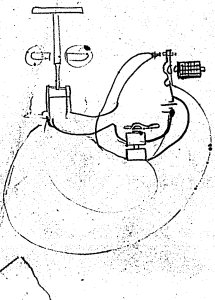






Exhibit

May 12 1879
T A Edison
Chas Batchelor

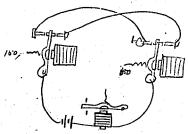


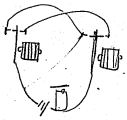
Ex Duplex

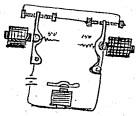
May 13 1877

J A Edison

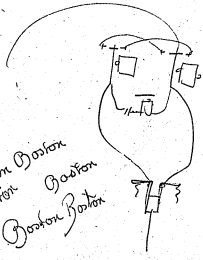
Chas Batchelor

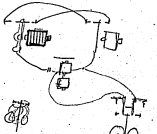






This works the best of all. Reversals and the 100@50 mean (almost) dont affect it enough to prevent fair signalling.





Boston Boston Boston Boston Boston Boston

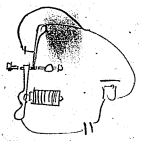
Try

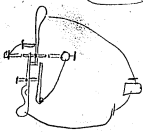
Try

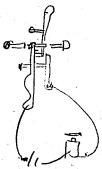
Diaphragm

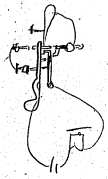
May 13, 1877

J. A. Edison







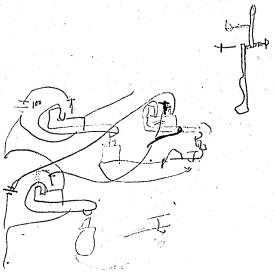


Description

May 13 1847

T. A. Edison

Mary Batchelor



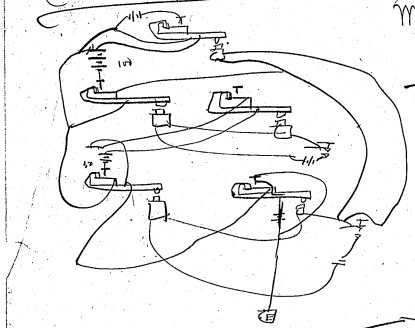
Extuplex

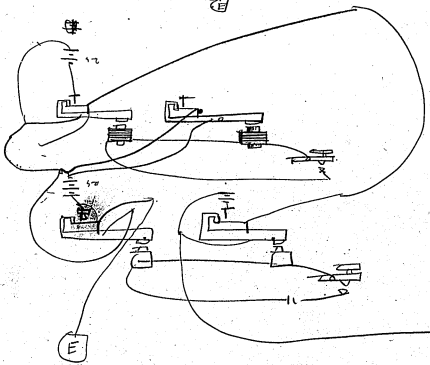
May 13 1877

T A Edison

Charles Batchelor

James Adams

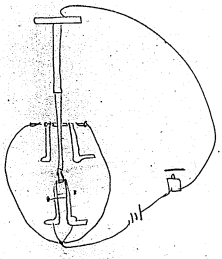




Specification

May 13 1877

7a Edison

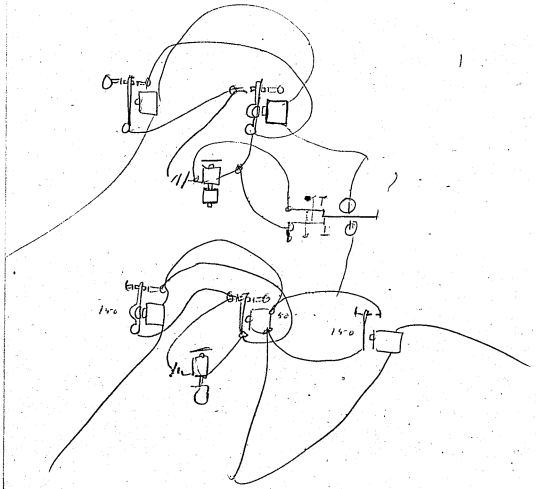


Duplex

May 13 1877

T. A. Edison

Charles Batchelor



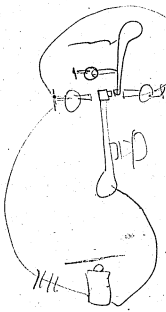
Sculptor

May 13 1877.

T A Edison

Chas Batchelor

James Adams



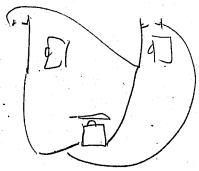
Bachelder

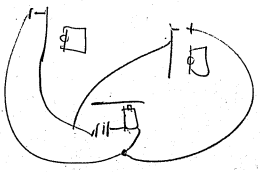
May 13 1877

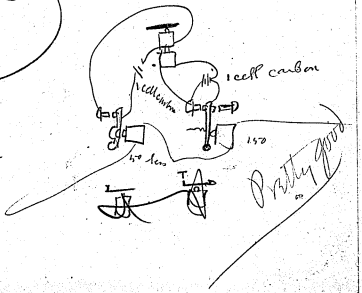
T A Edison

Chas Batchelor

James Adams







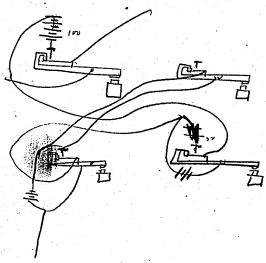
Duplex

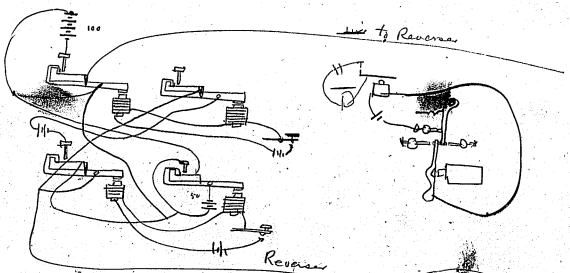
May 13 1877

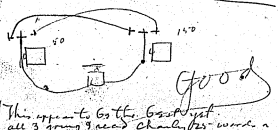
T. A. Edison

Chas. Batchelor

James Adams.



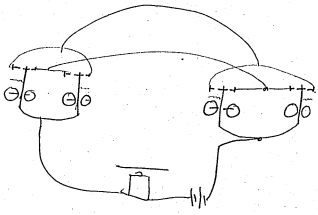


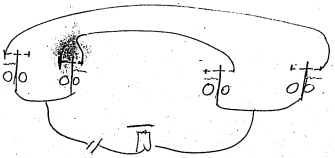


May 14 1877

T. A. Edison

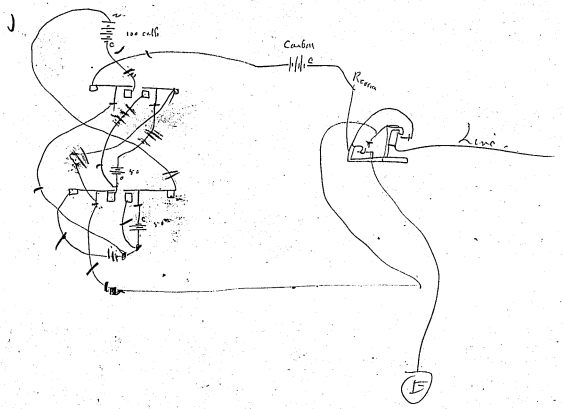
Edison

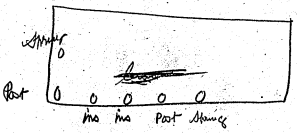


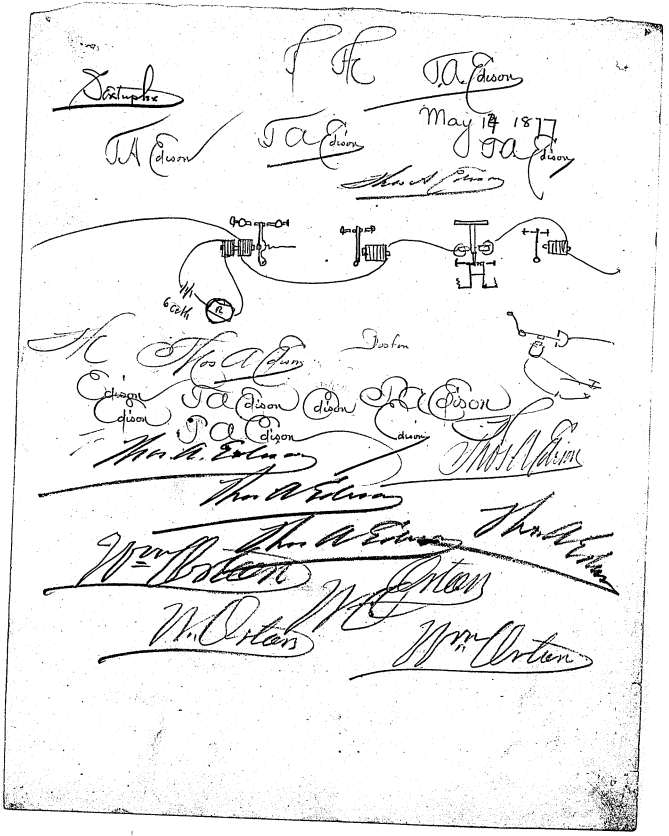


Dextroplex.

May 14 1877
J A Edison
Ra? Batchelor





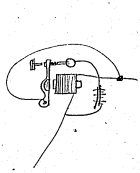

May 14 1877
6 Cells

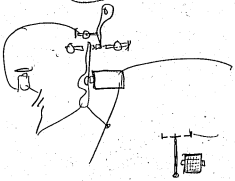
Duplex

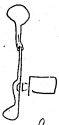
May 14 1877

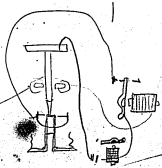
T. A. Edison

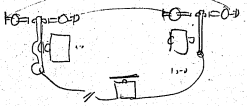
Chas. Batchelor

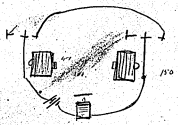








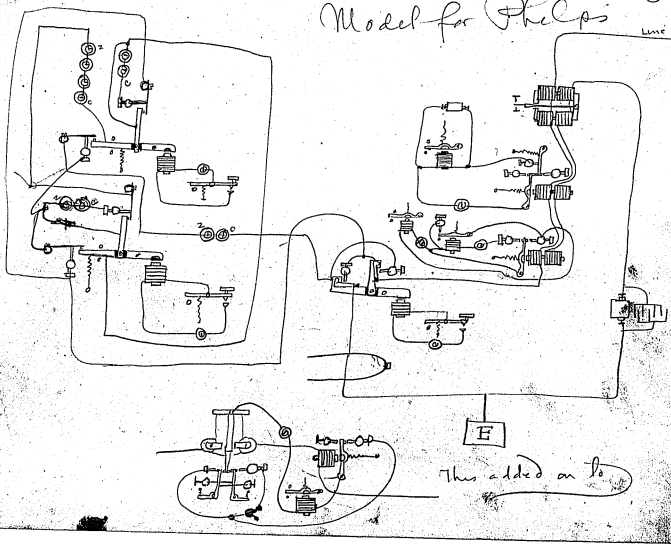




Sydenham May 14 1877

Model for Phelps

T A Edison



This added on 1

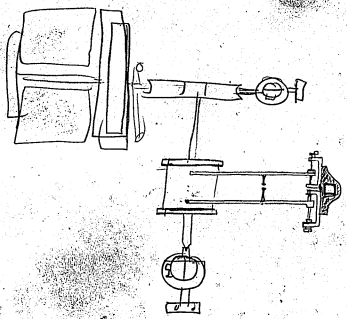
Duplex

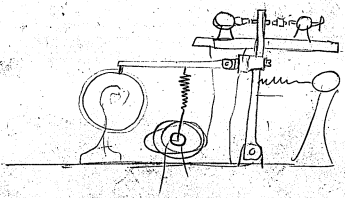
May 14 1877

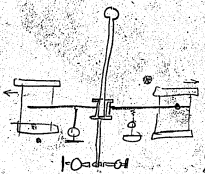
T. A. Edison

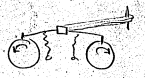
Delld. May 17th 1877

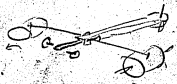
Jno. Ritchie Jr.







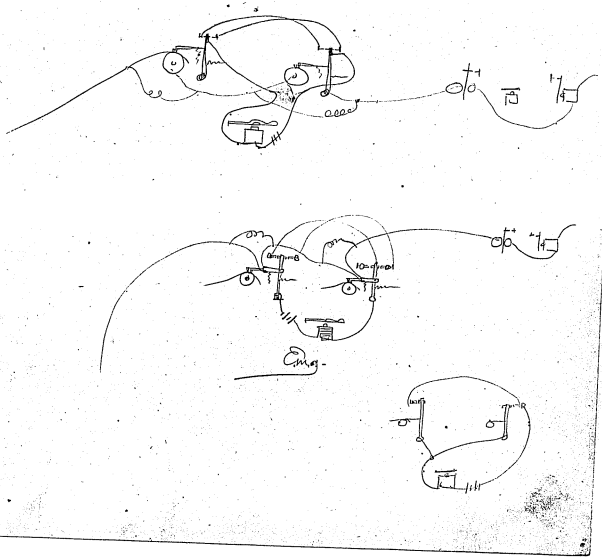


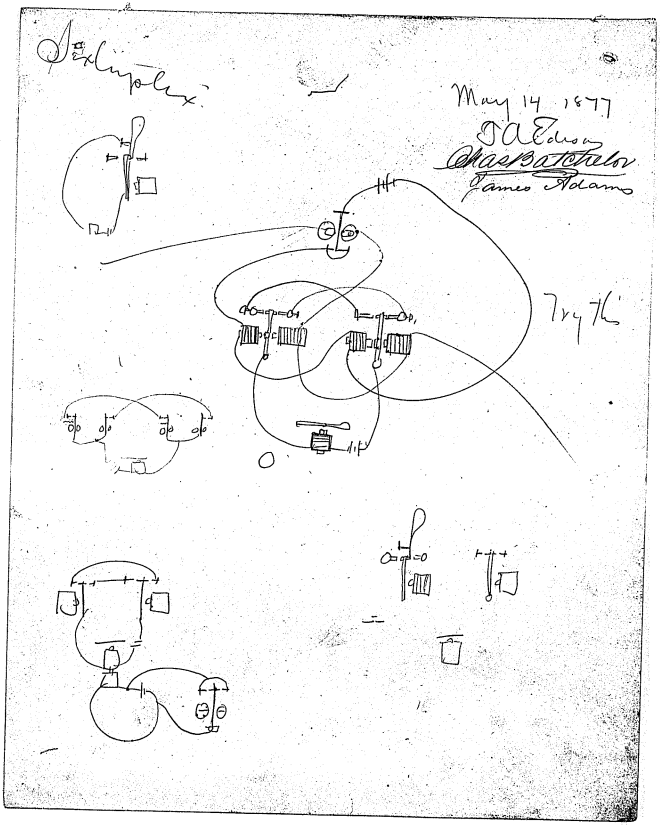


1/14
102

Duplex

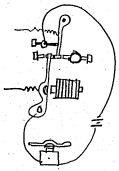
May 14 1877

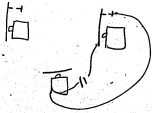



Duplex
May 14 1877
T A Edison
Mass Patentee
James Adams
Try 7h

Sextuplex.

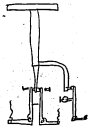
May 14 1877
T. A. Edison
Chas Batchelor
James Adams

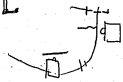


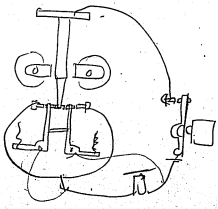


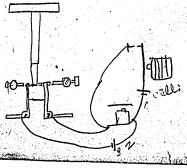
Stitt

May 14 1877
7a Sale
Chas Barkalow
James Adams









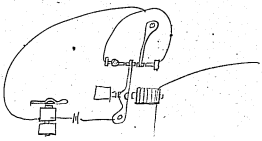
Duplex

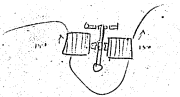
May 14, 1877

T. A. Edison

Chas. Batchelor

James Adams



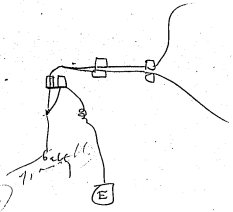


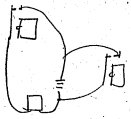
Duplex

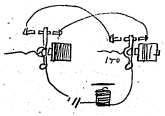
May 18 1877

go Hyp back to head ants shunt for closing Quad Rem &c

Chas Batchelor
James Adams







Thomas A Edison

Thomas A Edison

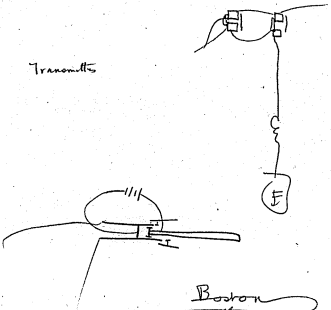
May 18 1877

T A Edison

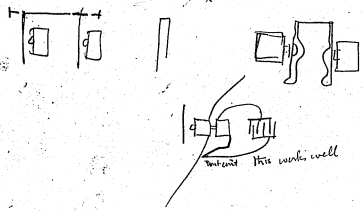
Chas R Batchelor

James Adams

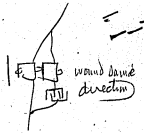
Transmitter



Boston



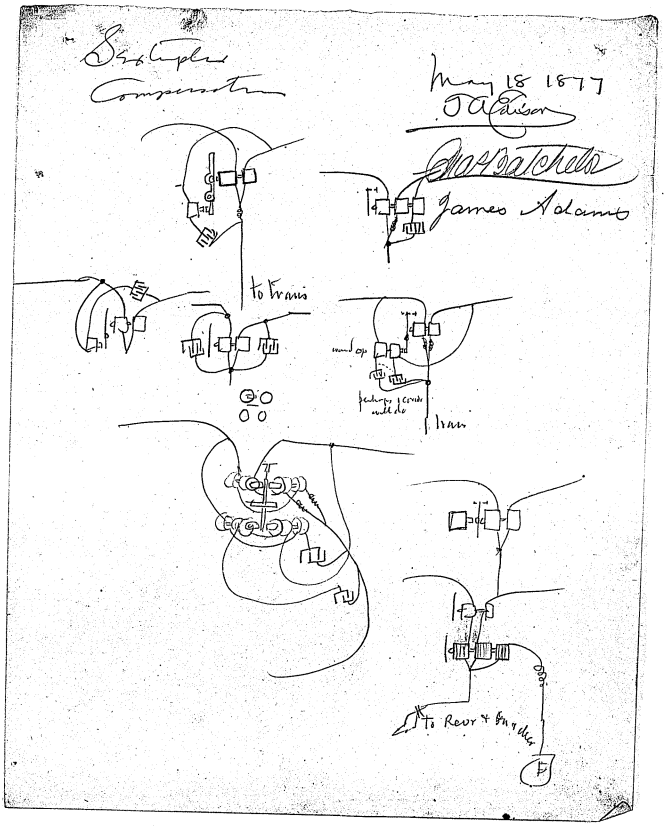
Instrument Works well



Sextuplex Compensator

May 18 1877
T. A. Edison

Massachusetts
James Adams



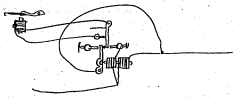
Duplex

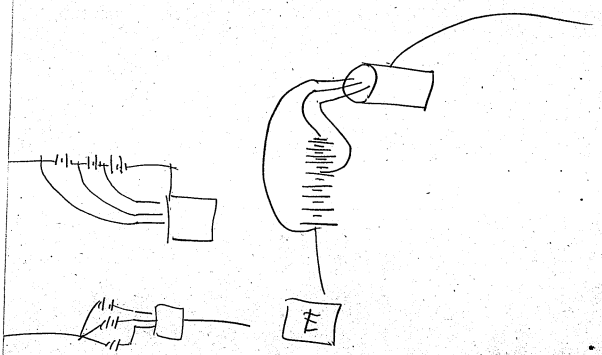
May 18 1877

Joe Edison

Charles Tainter

James Adams



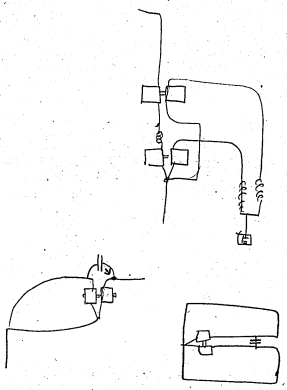


Sir Cuplex

May 18 1877

J A Edison

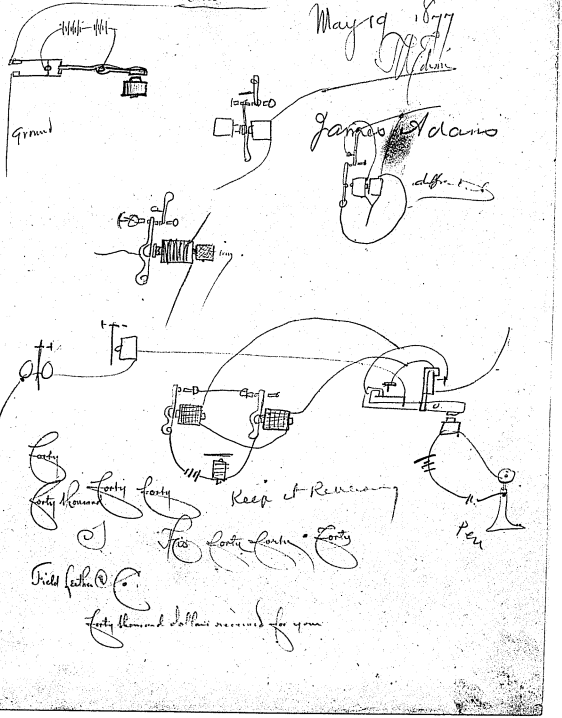
James Adams



Duplex

Line

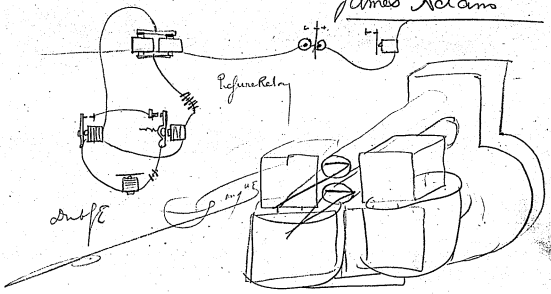
May 19 1877

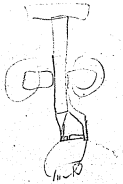


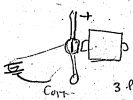
Duplex

May 19 1877

James Adams

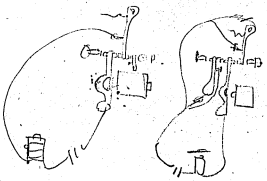




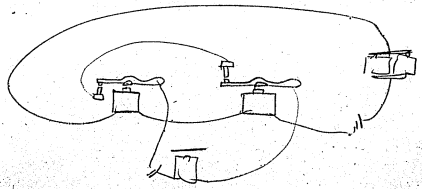


3 Layers Gamble wire
2 cells Carbon; not
Shunt mfs with
100 coil. = 4600
ohms

May 19 1877
T A Edison



3 mc + dec no Rev

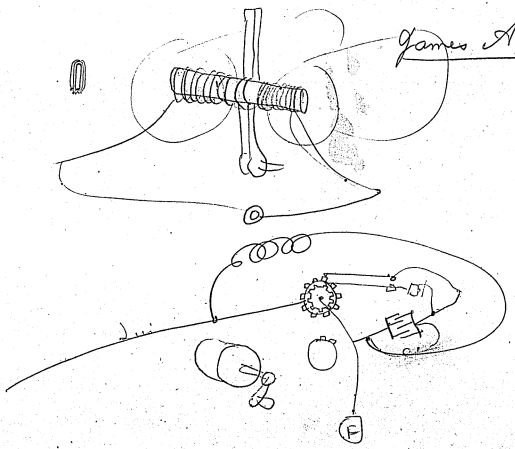


Duplex

May 19 1877

T A Edison

James Adams



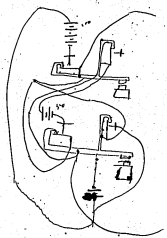
Telegraph

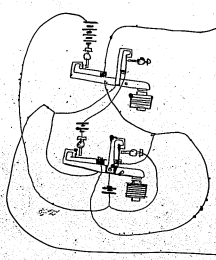
May 20 1877

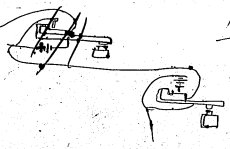
Thos A. Edison

Chas Batchelor

James Adams







Thomas

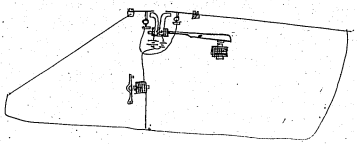
Fig 1

Fig 2

May 24 1887

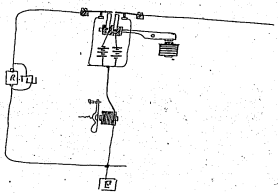
T A Edison

James Adams

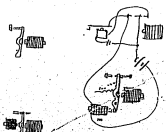


Apparatus of Balancing in
Duplex Quad & Septuplex transmission
without bridge adjustments

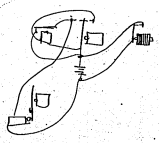
May 24 1874
J. A. Edson
Chas. Batchelor
James Adams

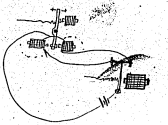


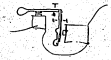
Modes of Hy Henley in
replacing galvanometer in
Duplex Telegraph - 9 miles distance
between Electric Telephone
or Connecting 40 cells Callen
to each pole pair =



Sextuplex



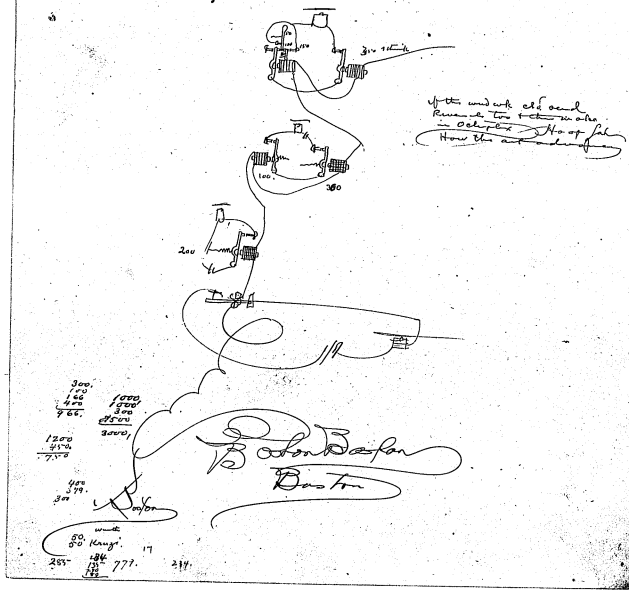




Discharge
without reversals
3 inverse + direct

May 25 1877
J A Brown

James Adams
Chas Batchelor

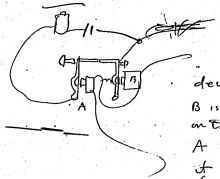


May 25 1897

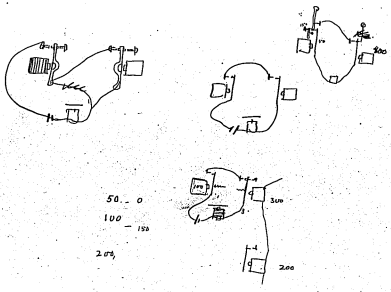
J. A. Adams

Charles Peterson

James Adams



device for reversing thro A & B is adjusted to close closed on the permanent Curnt. A to closed on the reversed it closes Local through Sect of B which at the moment of reversal flies Hook with the Lever of A and then prevents the Lever from being Broken



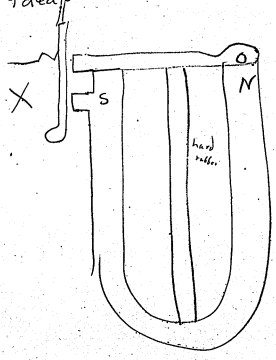
Discovery —

May 26 - 1877

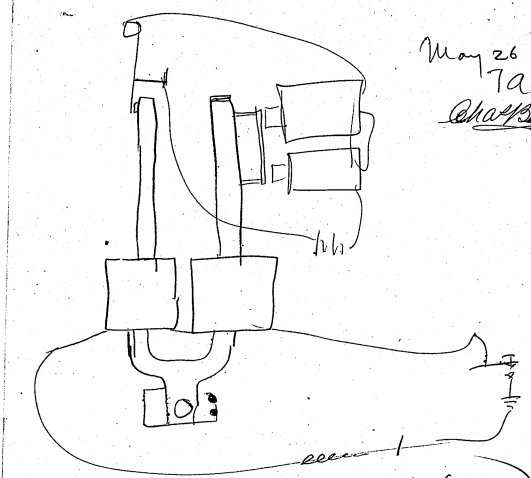
If you look very closely at any printed matter so that the print is greatly blurred and you see double images of the type and one of the double images is always blue or ultra violet =

Good Idea =

Chas Batchelor

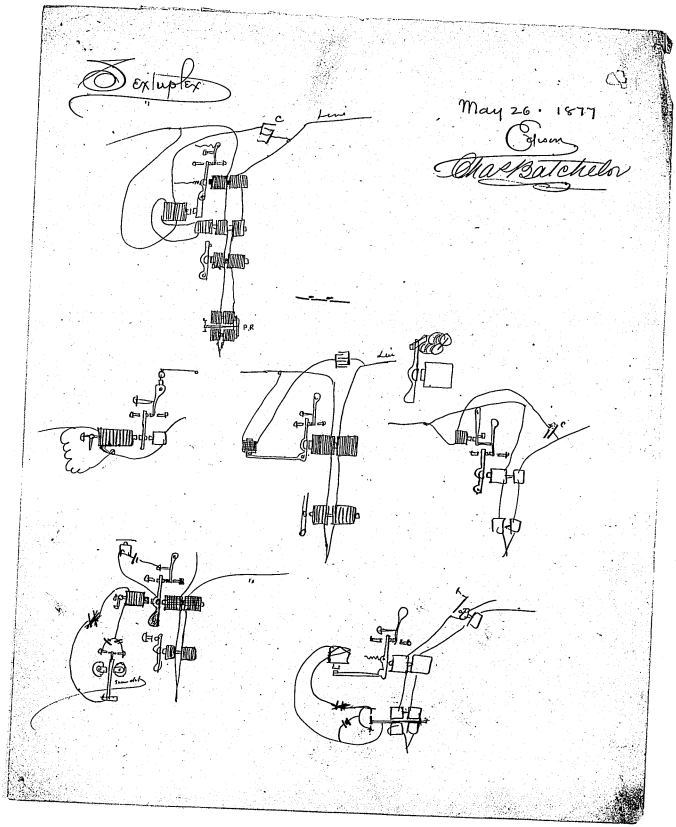


Expansion causes free poles at X & attraction magnet
this idea may be carried out in many ways =



May 26 1877
T A Edison
Charles Batchelor

magnetizing the shank after the fine and
you read by the Morse - might have
a 1/2 dozen - and among that while
one wound after its fine to a hundred, one
the Effect of the other would be to
make upper or Power Multiple

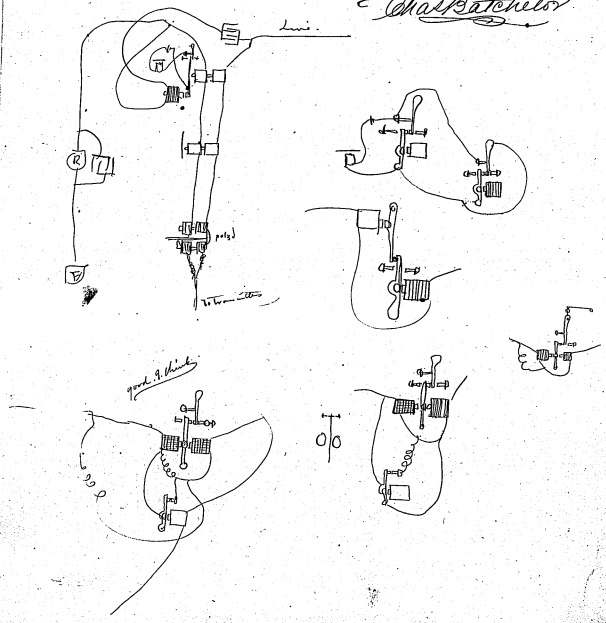

Duplex
May 26. 1877
Chas Batchelor

Duplex

May 26 1877

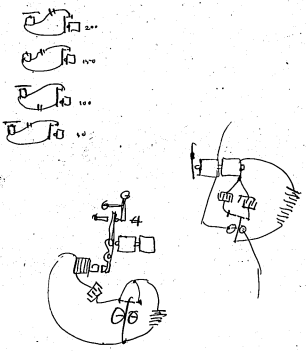
Edison

Chas Batchelor

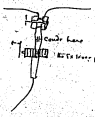


Extruplex

May 26 1877
J.A. Edison
Chas Batchelor



Attach in Quad to distant to take compensate for the polarized relay on the effect of taking off & putting on the Extra Battery to balance the Resistance equals here &c



Duplex

May 26 1877

Edison

Chas Batchelor

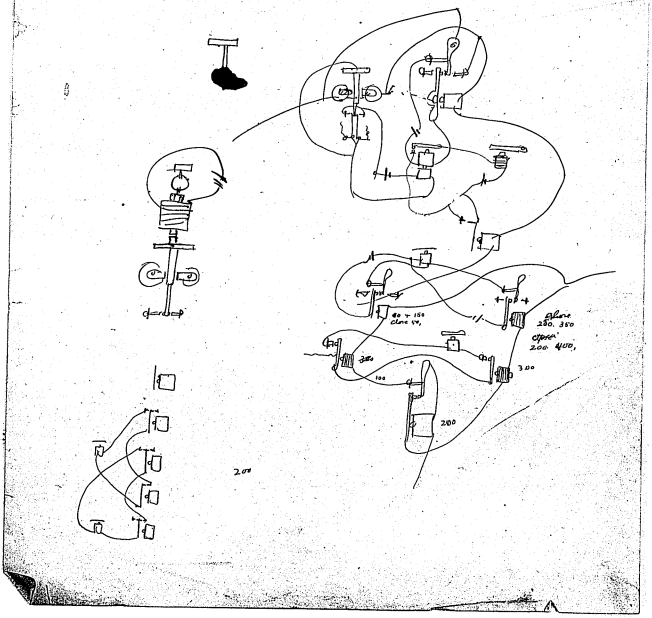


Exhibit Ex

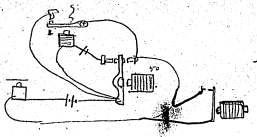
May 30 1877

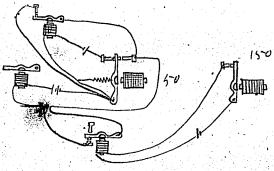
J A Edison

Edward Batchelor

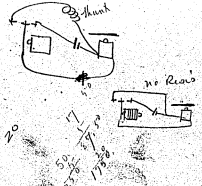
James Adams

good Try

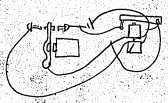




good try



good Try

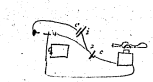


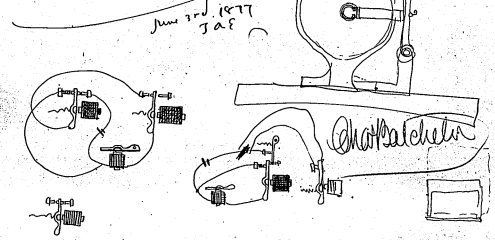
Telephone

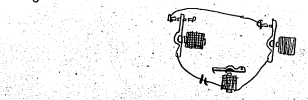
May 30 1877

JA Adams

James A Adams

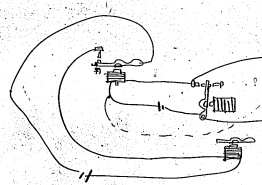




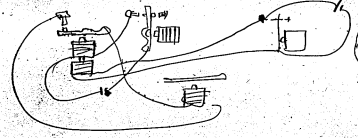


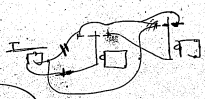
Dear Leo,

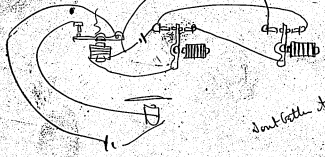
June 15-77



Pretty four out reverse ch
touch X





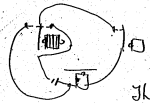


don't bother if you wish

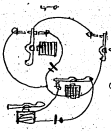
42

Duplex

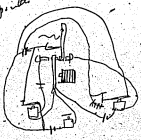
June 1 1877
Edison

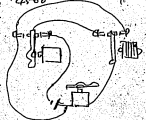


The works splendid
Scarcely a buzz in it
Besides it very Simple.



I think a repeating Sounder better G portion are owning to 150 relay working Sounder not shunted gives bright working when in 40 shunting Sounder in when Comes heavy hence all right no Buzz that working worked by micrometer screw of Sounder strength proved very the Sounder the Rounding Sounder reversed a Duplex thus I puts repeating Sounder in but 9t gave like 9 then put in Duplex 99 Sounder worked better scarcely buzz but it no great of any inputs or strength sounds with State off line 4400 Cohen fuel Condenser 9t works quite even scarcely a buzz =

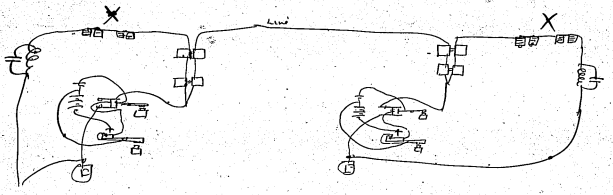




Pulling G. in don't appear to make it any better =

Stylus

June 1 1877.
T A Edison

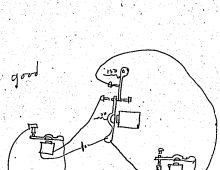


The object of the Electromagnets X at both ends is to create the same Conditions upon the artificial as there is on the line, and it is impossible to obtain an accurate balance unless the 2 relays of X are inserted to Counteract the Effect of the 2 Receiving relays at the Both Stations & vice versa =

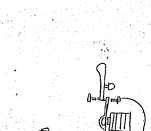
Sextuplex

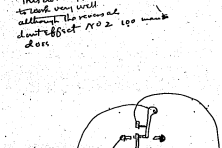
June 1 1877

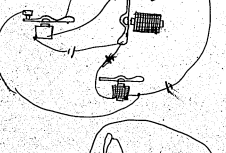
Edison



This dont appear to work very well although the reverse at 1 not affect N° 2 too much does





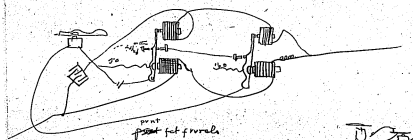


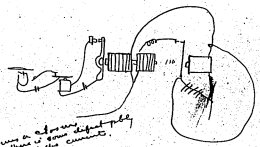
This appears to give about same as above except a should when 1 is open & N°2 does not when closing is opened = Reverse effect does when 2 is closed =

This is about same thing as X on previous page except only 1 Relay used

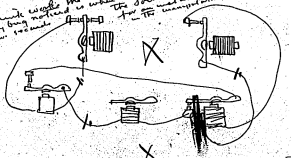
Sextuplex

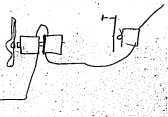
June 1 1877 -

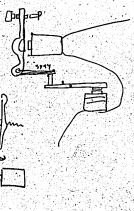


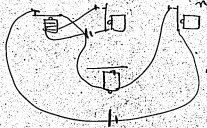


Three 9 thumb weights the first 50 mm if the diameter of the armature is 40 mm and the weight being rotated is taken 50 mm from the center of the armature. The weight of the armature is four times that of the weight being rotated.









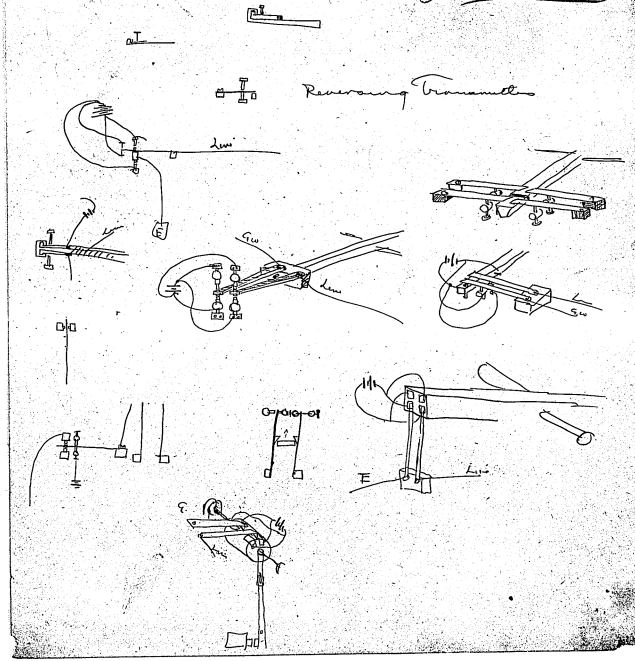
These don't work as well as X Coil in which less speed for the required

Duplex

June 1 1877

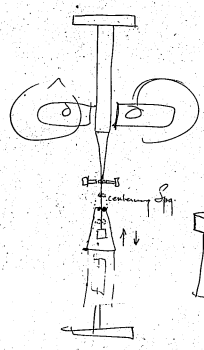
Edison

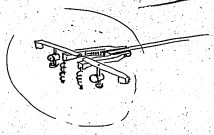
Reversing Transmitter

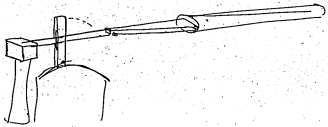


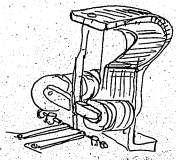
Sketches

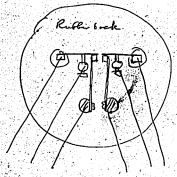
May
June 1. 1877
Edison
Chatterton

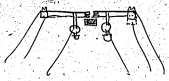












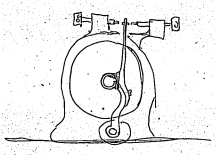
Dennys

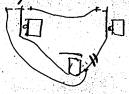
June 3 1877

Ja Edison

Chas Batchelor

James Adams





James Edmund Scott

Thomas Edwards

The Scottish Naturalist

The

The coast

The coast of heraldy

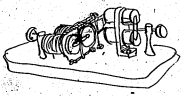
The coast of her

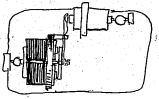
Fort of Tedras

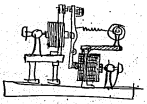
The coast of heraldy of pomp and power
all that beauty all that wealth ere
gave alike await the inevitable hour
The path of glory leads but to the
grave Grim visaged War has
smoothed his wrinkled front but

June 4th 1877

James Adams







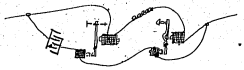
Sextuplex

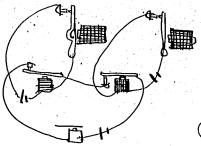
~~May~~ June 5 1877.

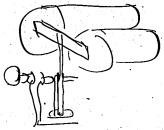
T.A. Edison

Chas Batchelor

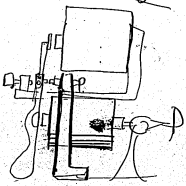
James Adams







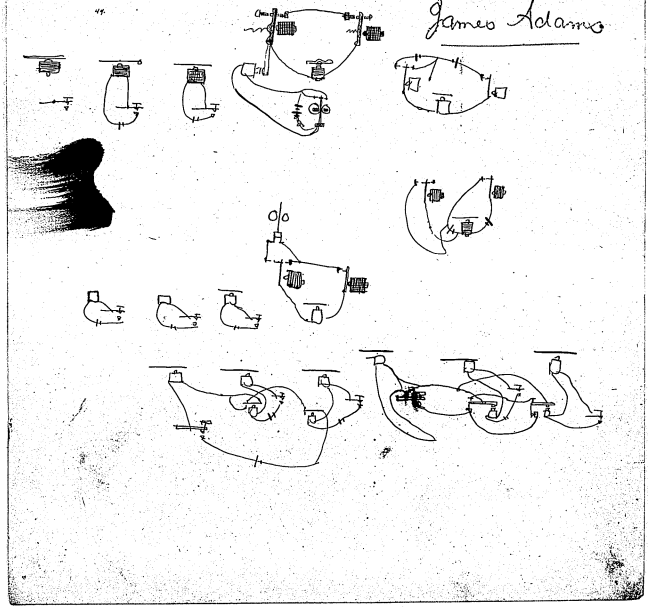
Krueger



June 5 1877.

Specification

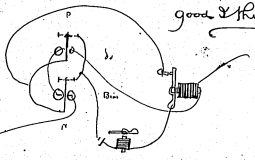
James Adams



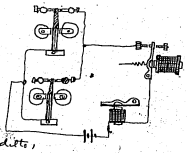
Jan 5 1877
Edin

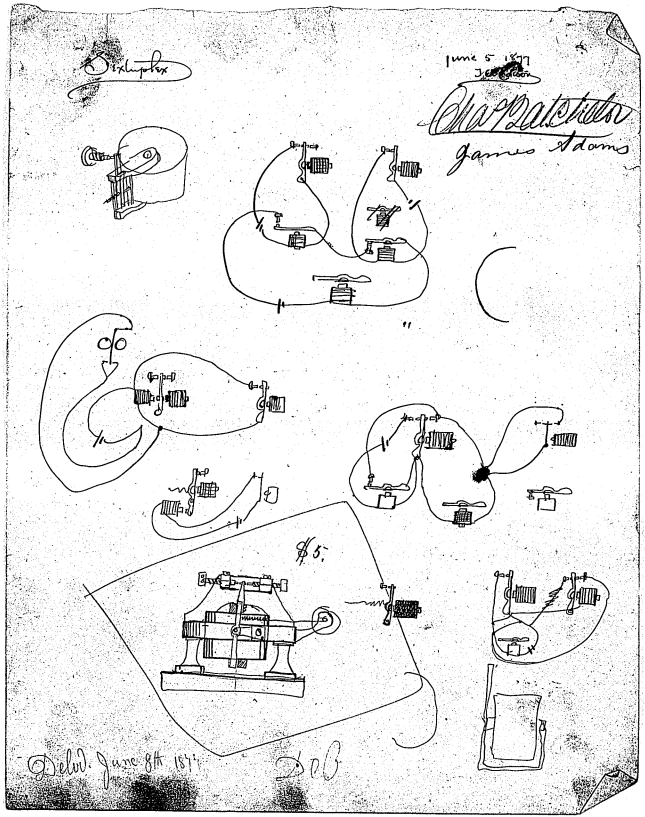
good & Rink

James Adams



The reversals gave a kick
Due to break in Continuity
in the passage of the
polarized Impulses.




Duplex
June 5 1877
James Adams
Fig 5.
Delvd. June 8th 1877

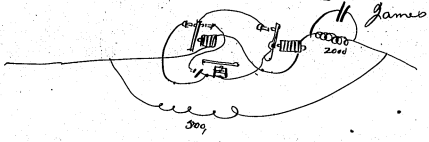
Duplex

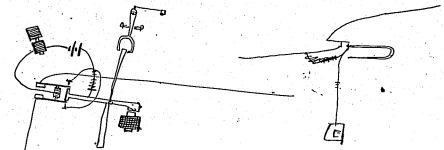
June 5 1877

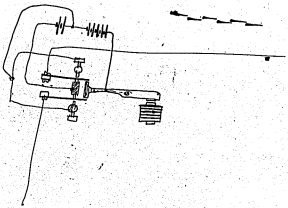
Date

Telephone

James Adams

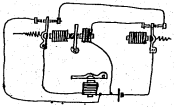


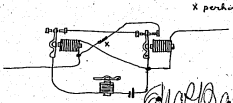




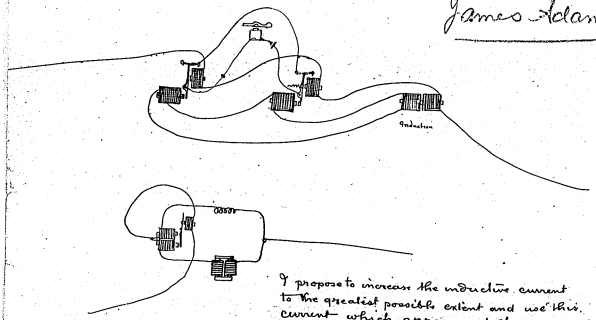
Sextuplex.

June 6 1877.

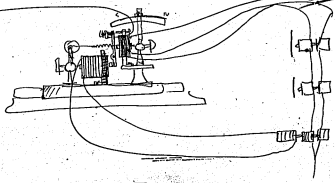




Duplicated
James Adams

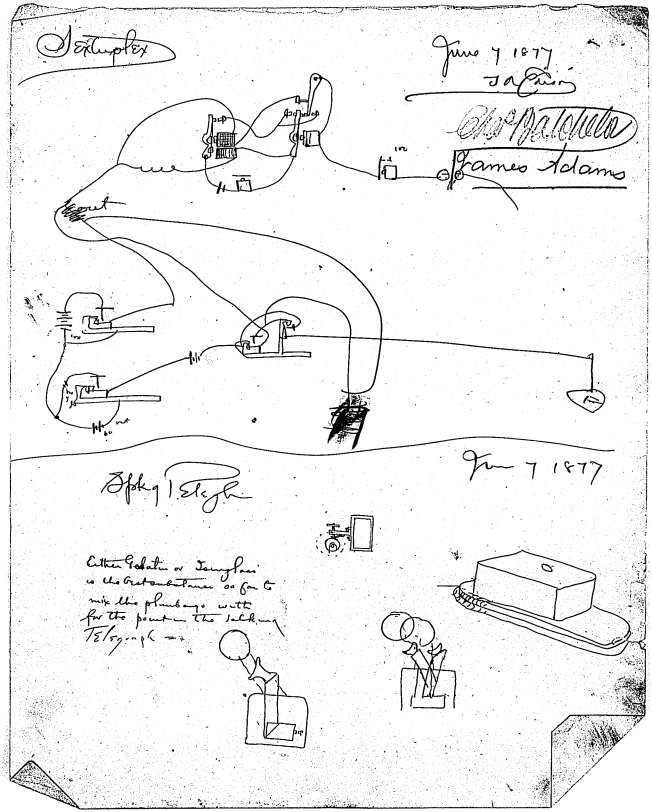


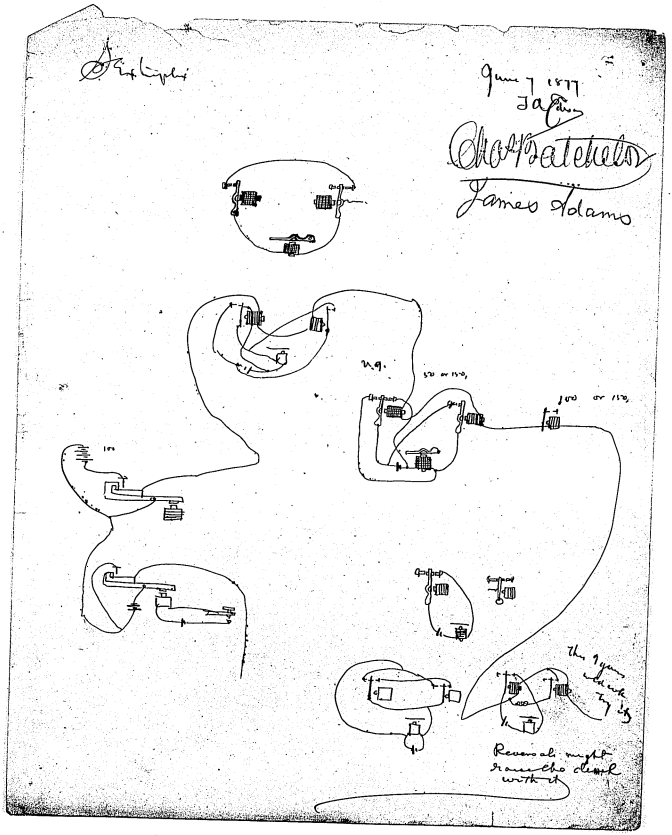
I propose to increase the inductive current to the greatest possible extent and use this current which appears at the moment of reversal to act upon a seperate Electro magnet, which tends to pull or attract the relay lever in the same direction as it is attracted by the magnet in the main line circuit, and by a proper proportionment of the two magnets acting on the same lever I hope to make the inductive current magnetism in one magnet equal in strength to the main Current magnetism in the other magnet, thus bridging over the interval of no magnetism in the main line magnet by a magnetism of equal power in the [illegible]



James Adams

Compensation by induction
Secondary Magnet
Rankin Water Power Power Power Power Portland


Stethophone
June 7 1877
J A Enos
Chas Grafulla
James Adams
June 7 1877
Telegraph
Cutting Gabriel or Longfellow
in the Gutta percha so as to
make the plumbago with
for the pointer the letters
Telegraph


June 7 1977
Jack
Choo Patents
James Adams
M.G.
50 or 150
100 or 150
1m
Remarks might remain the same without

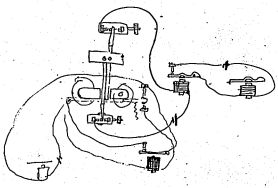
Duplex

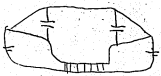
June 8 1877

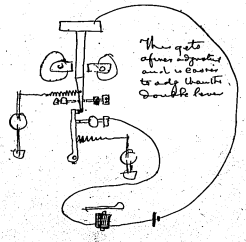
T. A. Edison

Chas Batchelor

James Adams



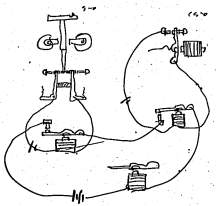




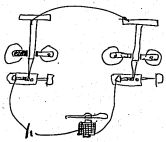
Sculpter

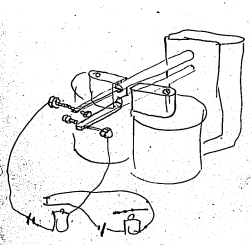
June 8 1877
Edison 11

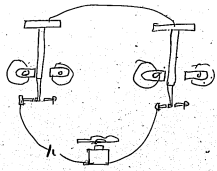
Witness
James Adams



Thermostatic Governor



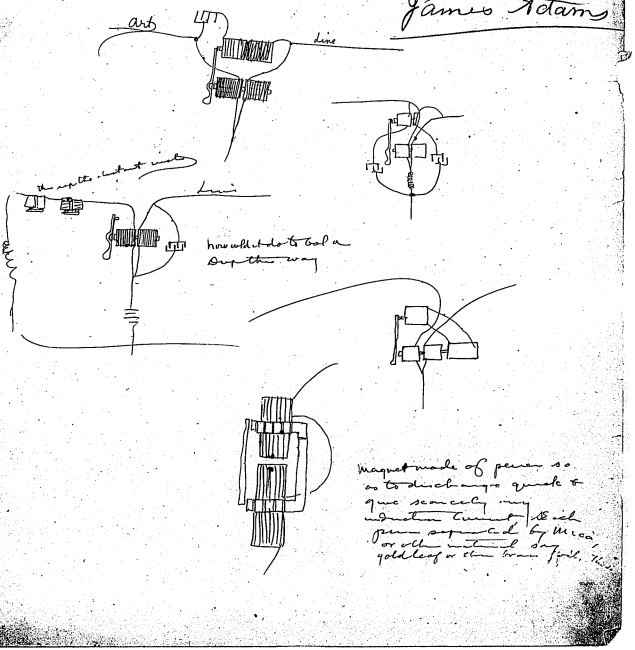




A. S. Sexiuplex

June 10 1877.

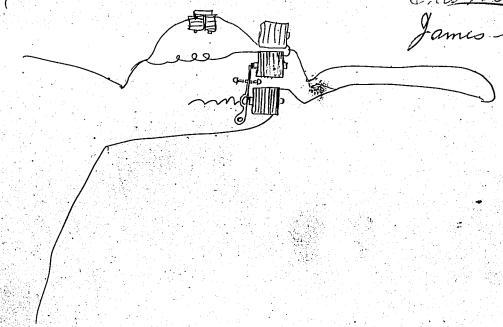
Witnesses
James Adams



that will send the type wheel ahead & letter
for a positive & 1 for a negative, operator &
Carry the use of an Embosser work a
transmitter in a local circuit & record
from the paper & send the same over the
wire recorded on a 2nd Embosser Tape &
then take the to a translating or Repeat
in the same machine and connect it to
a print & print chemically automatically

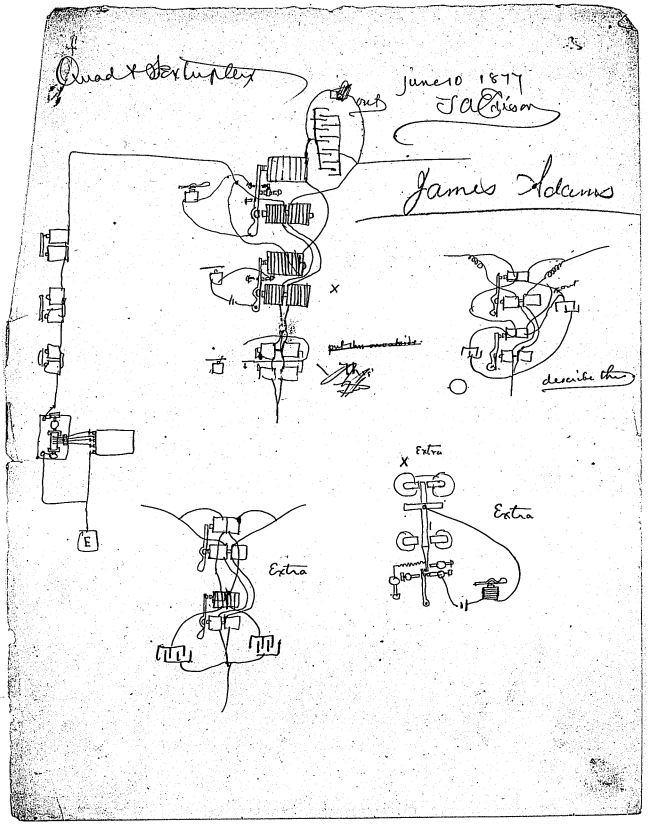
June 10, 1877
Edison

Phonoplex



Charles Batchelor

James Adams


Quad + Sextuplex
June 10 1877
T A Edison
James Adams
Extra
Extra
Extra
E

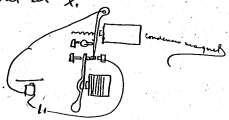
Quad & Sext Capstan

June 10 1877
T.A.Edison

James Adams

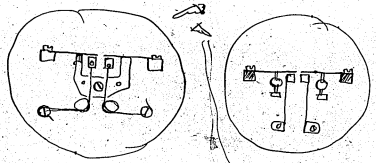
put this in

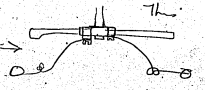
mention that station inductor magnet may be put at X.



Mention Condensers of thick dry paper only insulation so as to give low rate of expansion

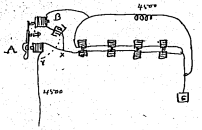
Show this in galvo;



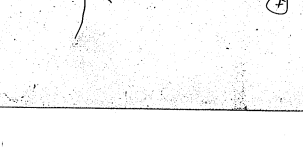


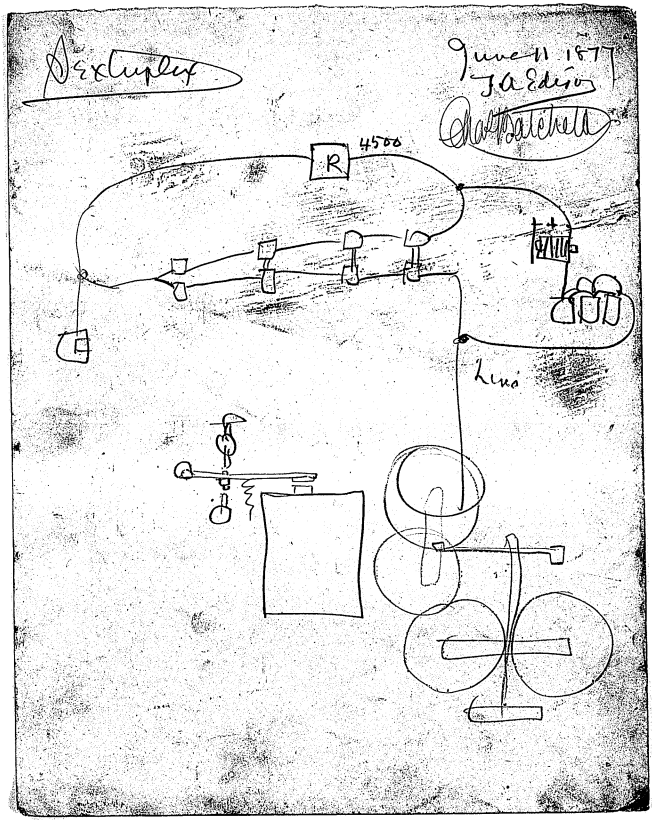
Dextuplex =

June 11 1877
T A Edison



With the 4 mf condensers the effect on A is to cause writing to come heavier by reason of its slight magnetism thrown on B by the Condenser current on opening & quickening it on closing & further with end of Condenser at V. instead of X the writing is lighter, therefore the Armature cannot be attracted solely by the whip & giving motion to B. probably the discharge or effect of the Condenser on the magnet would be to make the living and the wound Register it together with the whip & momentum, the amount of Condenser charge & discharge with when operating by reversal of Battery is exceedingly small in Comparison with that due to reversal perhaps 1/40 to 1/50 the part on string: even with No 2 of 150 ohms the current barely moves the armature, I find that with the 60 coil No 1 the effect of permanent magnetism in the relay has very bad effect and with the top Magnet arrangement of Form the writing is rendered lighter when reversals are sent But you Can get writing good at 40 or 50, with the front point even when rapidly reversed. Tried this the other night & it appeared to work when I had Condenser shunting the Current by a shunt around a 400 ohm short coil relay but with the above arranged the Relay C being in the line & D in the Condenser ckt the reversal showed.




Dexcupley
June 11 1877
1A Edison
R
4500
Line

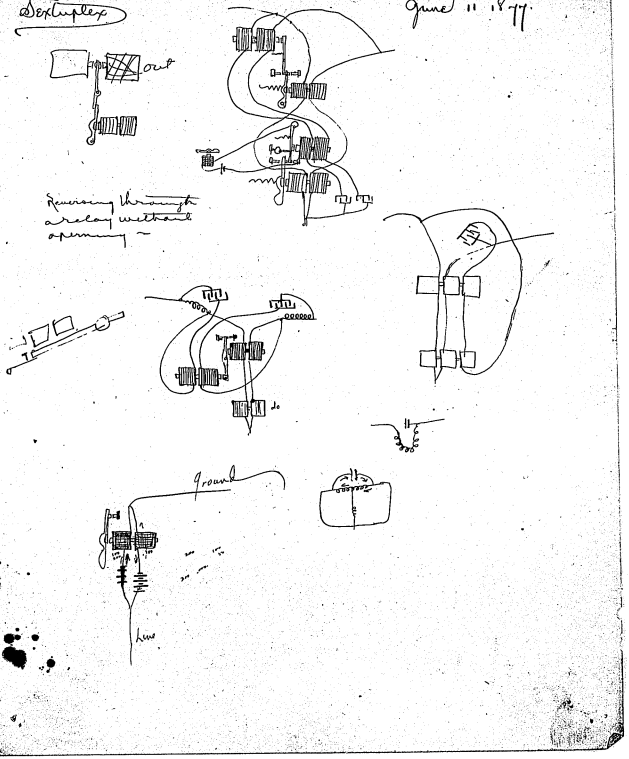
Duplex

June 11 '77

3

out

Running through
relay without
opening

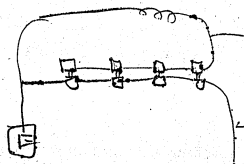


Sectember -

June 11 1877

Experiment

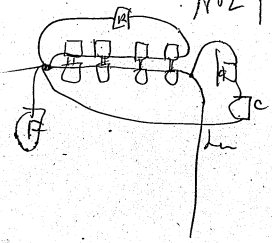
No 1



With 7 Mf. of do not get any better Kick on X than with 1 3/4 Mf or 72 Sheets Connected thus

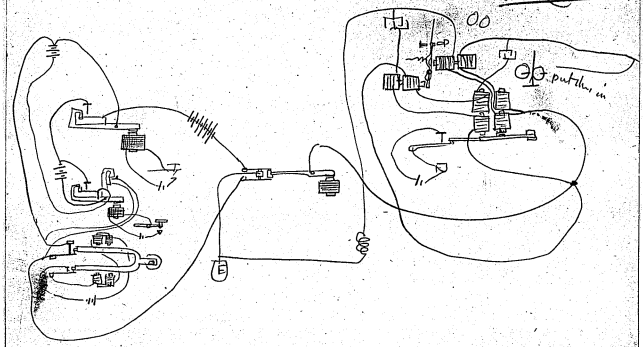
Line

No 2

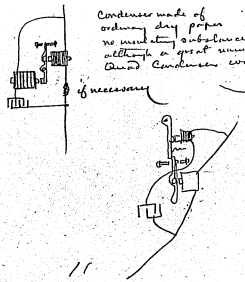


Besides putting the Condrs as in No 1 it makes a bigger no magnetism line than in No 2. I think the Cond on Boom is not good -

Acoustic Duplex = June 12 1877
T. A. Edison

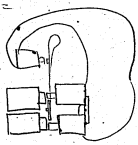


This with relay that I sent open on a reversal



11

Duplex =

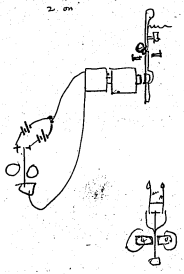


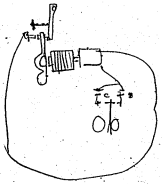
June 12 1877
J A Edison

30, 60, 100.

100.

2 off 75
2 on





50, 100
100
250

work No 1 with 30 cells, No 2 with 60
and open 1 when two is closed with 75 extra
or 50 No 1 100 No 2 open 1 with 2 closed by 100 Extra

50, closed, 1 125.
75 " 2 "
"

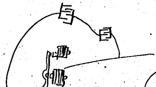
Dexcuplex

June 13 1877

TAEdison

James Adams

I find that doubling up 4 Condensers this contrivance it doesnt have 1/3 effect of quantity style. thought it would give a quicker dump short & big end at first but alas!



Porter Lowrey Soren

Soren

Porter Lowrey 1750,

Soren and Stone

4/7000

Porter Lowrey Soren & S

1750
4
7000

Twenty Thousand Four Hundred Eight

350

Thompson French and Co

Boston

Boston 1000

$5,000.

Porter Lowrey Soren

Porter Lowrey Soren and Stone

70
4
2,800,

Meggafarad

1400

2000
7000,
4000,
2800,
15,800,
3,000,
18,800
3,000
21,800

20000

7

Twenty Eight 21 Mil

Mike Farrid

Porter Low

Michael Farad

Lowrey

Lowrey

Farad Protochloride of carbon

Porter Lowrey Soren and Stone

No 1

Boston

Porter Lowre

now is the winter

Boston Boston

Lowrey and Stone

Boston Boston

Washi

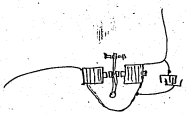
rey Soren

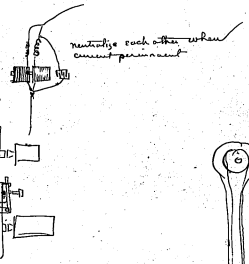
Porter Lowrey and Stone

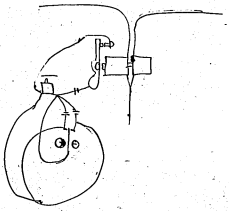
Hamlin

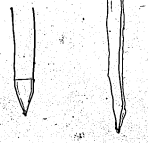
Sextuplex

June 13 1877
J A Edison
Chas Batchelor
James Adams





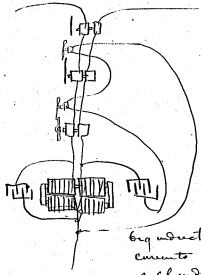




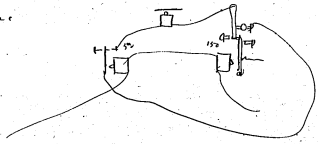
Duplex

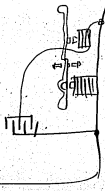
June 13 1877

James Adams



by induction magnet diverts
current into Condenser by its
self induction and Magneto
excites in ch arriving polarities

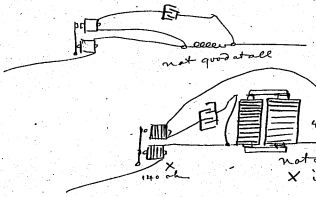




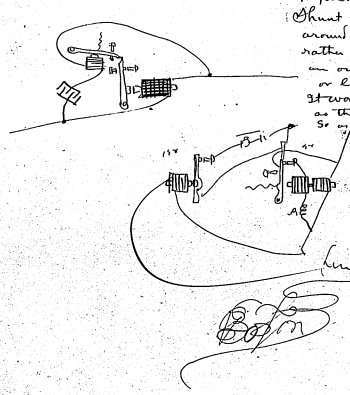
Dextuplex

June 18 1877

Edison
Chas Batchelor
James Adams



I find that it is better to shunt the Condenser and magnet around the coil magnet rather than around or around an outside separate resistance or low magnet a 3rd work perfectly as long as the regular magnet is adjusted so as to give only a moderate back or resistable force if magnet comes right up + heavy copy put on the armature by Grover, [illegible] power of spring relay is of course the Condenser coil [illegible] to be [illegible] [illegible] neutralize 100, 500

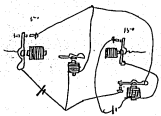


Sam

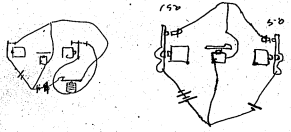
Duplex

June 14 1877

T A Edison



give 150 more the advantage in strength in Sounder magnet so a little excess of his current will neutralize Self magnetism of S. Is altogether this may not be essential,



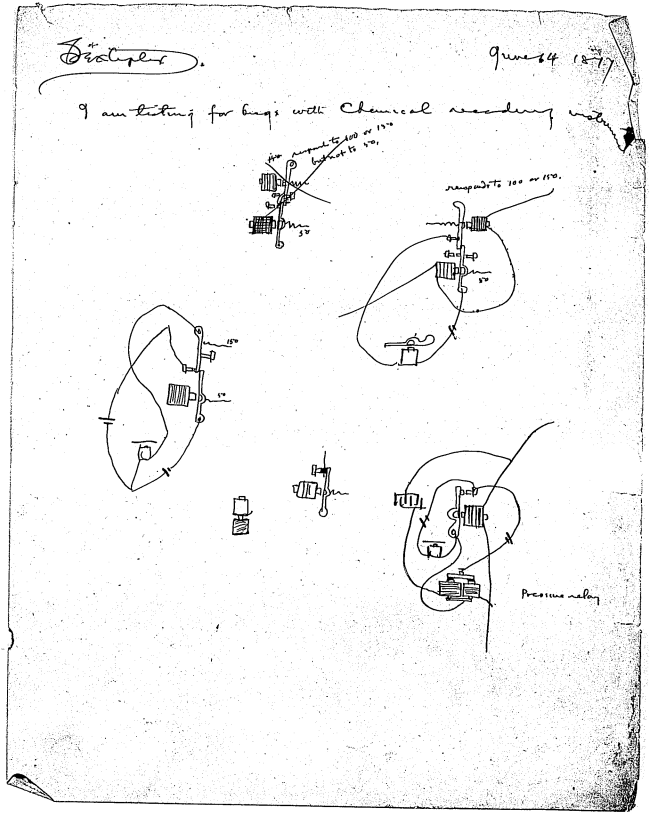
This works well ~~still~~ the ---- key is on this. but this time it is opening before two on closing

The trouble is Caused by the 50 relay having a light adjustment; ~~the~~ addition of the 150 causes a permanent set on the Cores so that when all Current is taken off ~~that~~ the lever of 50 dont fly away as soon as that of the 150, if 150 may is adjusted so it will vibrate up & of the same Cores as that of 50 then its Cores are further away & act quicker = ? see the Effect by the local spark on 50 ~ point the ~~the~~ Levers ought to leave at once but the & no spark appear but as a spark does appear ~~when~~ at on 50 point ? either that the lever is slow & it should be shortened

Dr Taylor.

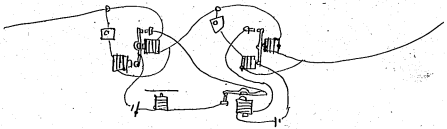
Queen's 1877

I am testing for lungs with Chemical recording [illegal]



Specification

June 14, 1877.

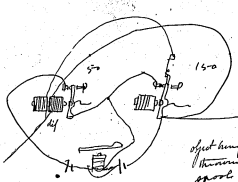


Duplex

June 17 1877

Edison

Chas. Batchelor



Object being to get underlettered set by
shunting in an extra opposite wound
spool to centre of the 150 ohm
but still leave 50 ohms when all
but still leave 50 ohms when all
open The 50 relay will open
probably as there is only 50
possibly as there is only - 50
call magnetism in all cases,

Chas. Batchelor

Batchelor

Chas Batchelor

Chas Batchelor

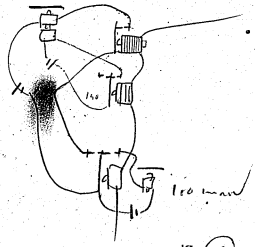
Chas Batchelor

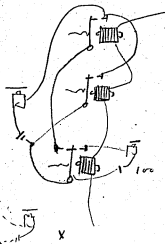
Chas

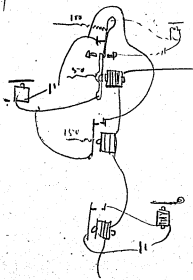
Batchelor

Acetuplex + Quad

June 21 1877
Jackson
Charlie





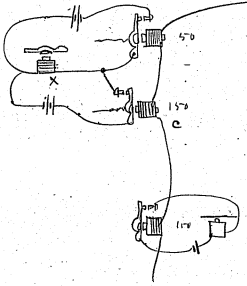


Duplex + Quad

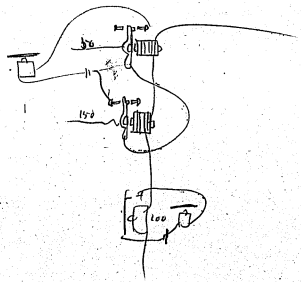
June 21 1874

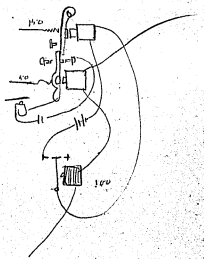
T A Edison

Autograph Telegram



50. on perm X open to close X take off all battery or when 100 ohm on a C attracted put on 50 cells to close then close at the transmitter Edison





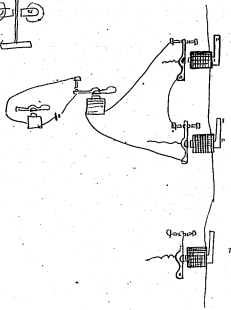
Dextuplex Quad Etc

June 21 1877

J.A. Adams

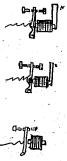
Inventor

James Adams



V.B

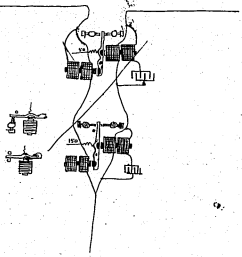
Boston Boston

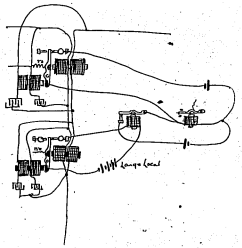


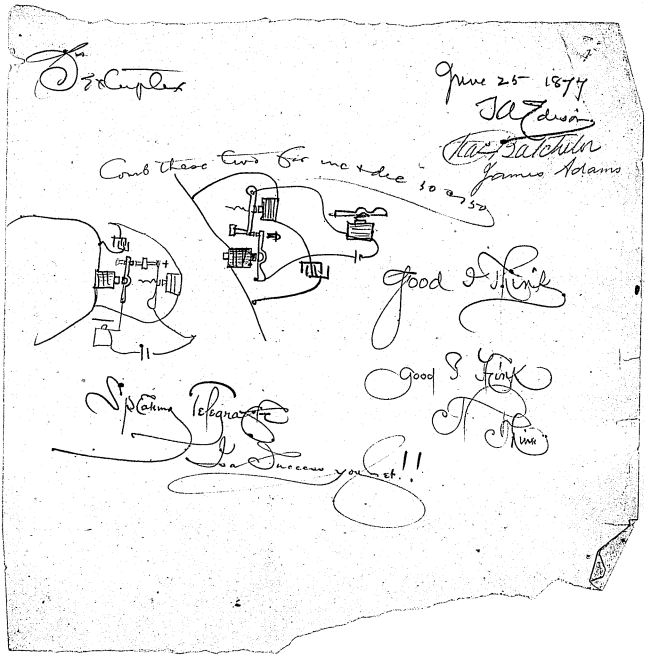
Sidney

June 22 1877

Has Batchelor
James Adams



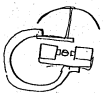



June 26 1877
T A Edison
Tom Batchelor
James Adams
Good Night
Good Night
Speaking Telegraph
Can't recieve you yet!!

Quadruplex & Sextuplex.

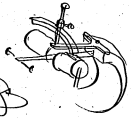
July 5 1874.

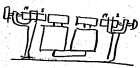
James Adams



C

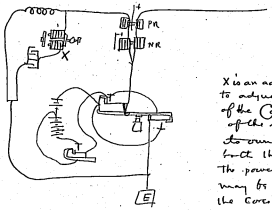
Permanent Magnet
Corrector on Quad
Enlarged Poles



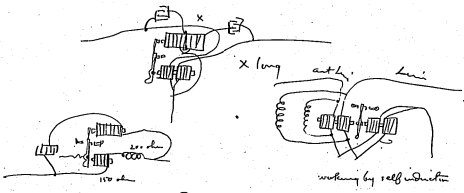


Quad + Description

July 7 1877
J. A. Edison
Chas. Batchelor



X is an adjustable magnet to adjust the charge + discharge of the Condenser to meet that of the line which is done by its own self induction delaying both the charge + the discharge. The power of the self induction may be regulated by adjusting the cores to or from the next armature.

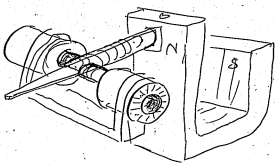


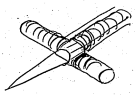
a relay you can measure through without opening =

To get rid of the permanent magnetism or act in a magnet opposite a polar relay under Quad 9 per space to use from coils of larger # of wire or wires =

Amalt Tait Cuff

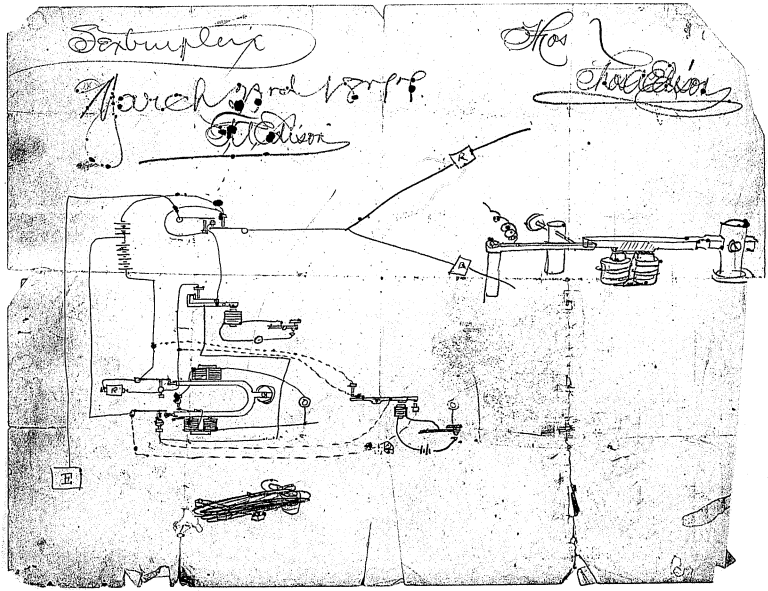
July 7 1877
70 Nassau
Chas Batchelor





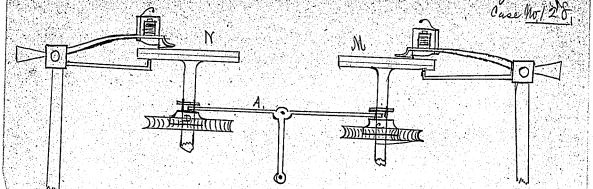
Hollow spools to such in light extremities of the polarized tongue, passage of the Current Cause no permanent magnetism in the wire below or that is no limit to magnetism and if the tongues magnetism is increased or decreased it would make no difference as there is nothing to attract it or it to be attracted by

Plumbago 1 inch wide 1/8 in Thick
Weight 16 Grams Ron No Road, over 10.000 ohms
" 66 " " 700 "
1/2 lb " 3,00 "
1 lb " 60 "


Sextuplex
Thos A. Edison
March 3rd 1877
Thos A. Edison
R
A
B
C
D
E
F
G
H
I

[March 1877]

Fig 5.
Case No. 128



[March 1877]

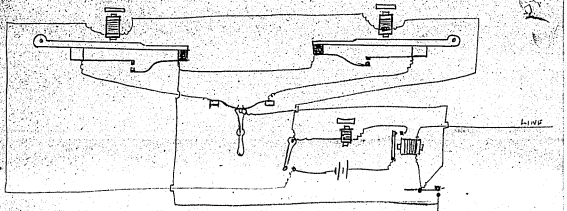
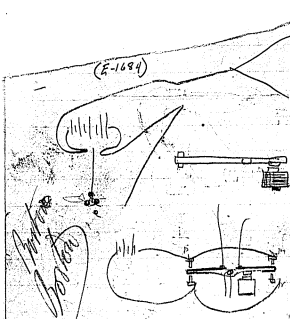
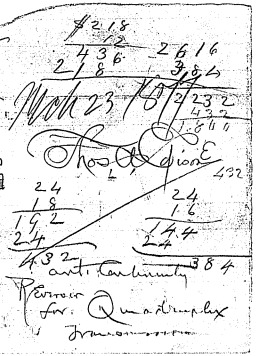


Fig 4 Case No. 128.

(E-1684)

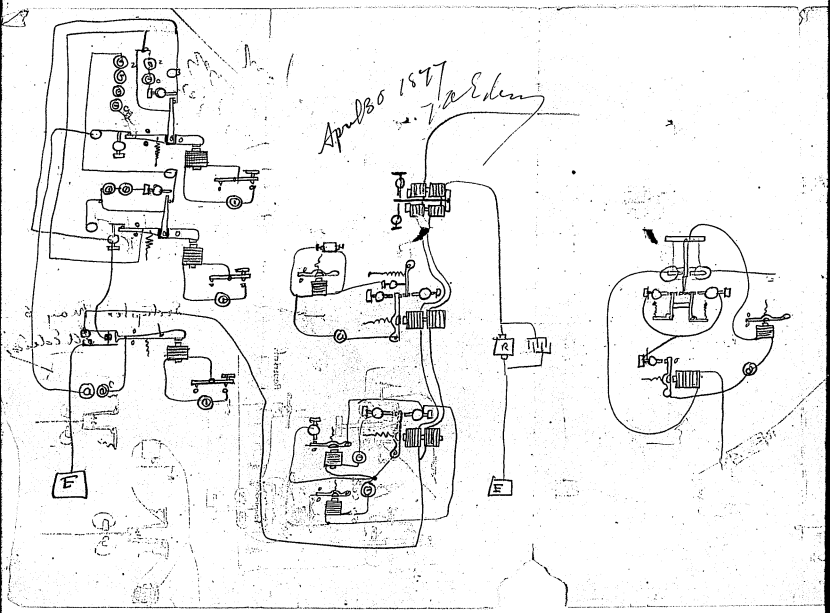


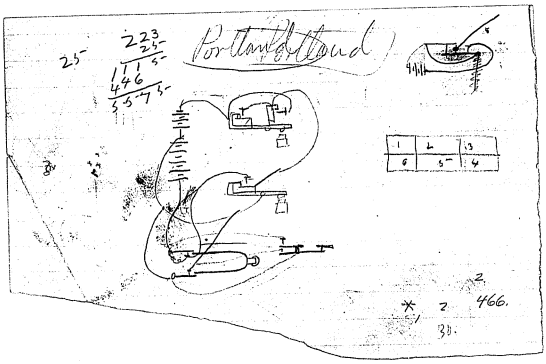


March 23 1877

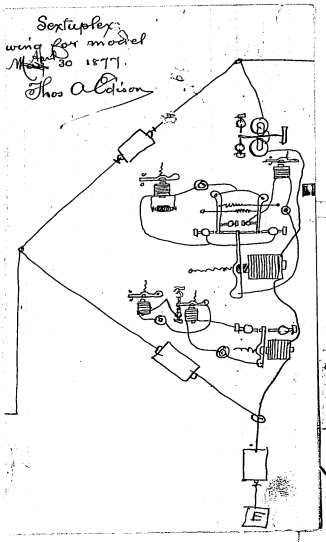
Thos A. Edison

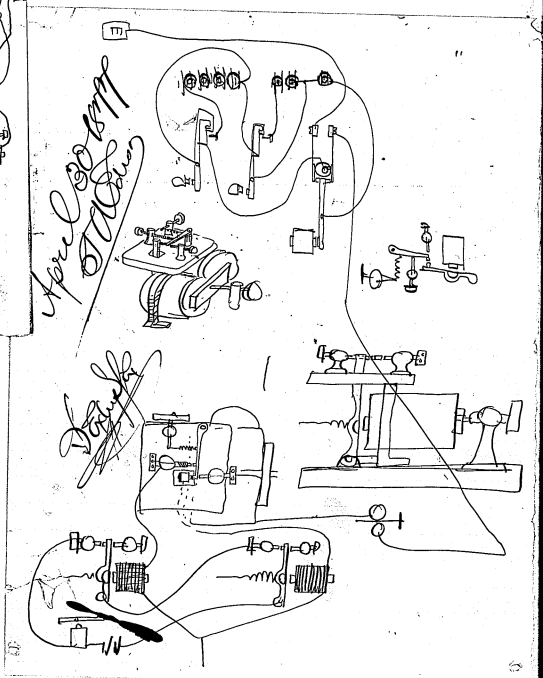
Reissue
for: Quadruplex


April 30 1877
J. T. Sidney
E
E

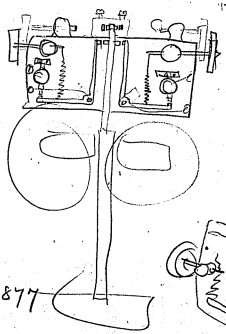

Portland Outbound
25
223
25
5
1
1
446
5
5
7
5
1
2
3
4
5
6
1
2
3
4
5
6
2
466.
30.

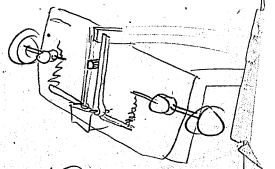
Sextuplex
wiring for model
April 30 1877.
Thos A Edison





#10,



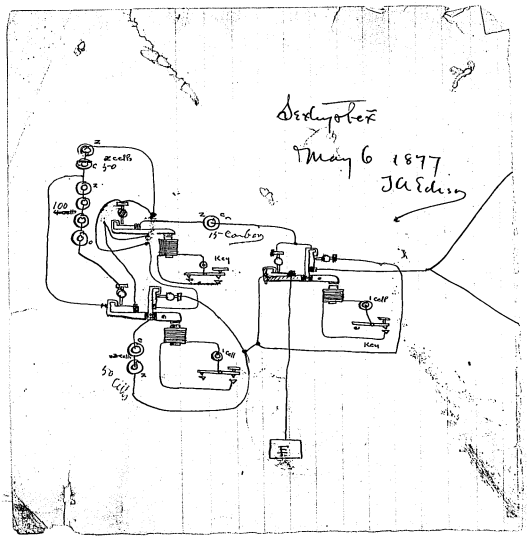


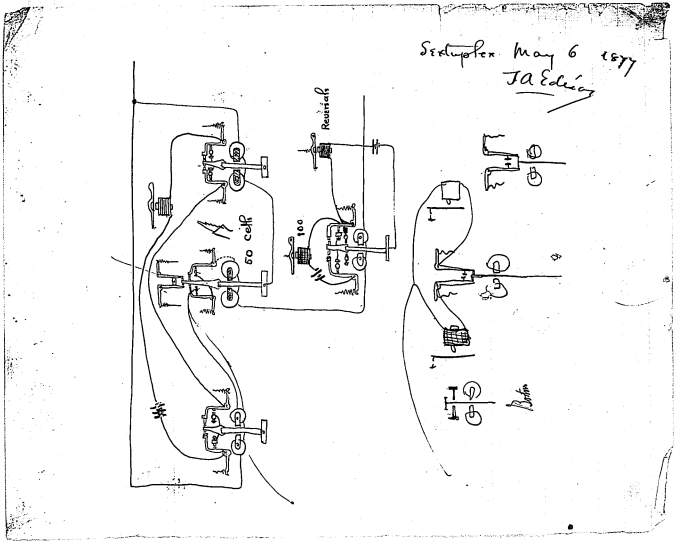
May 3rd 1877

Sixtuplex

T A Edison

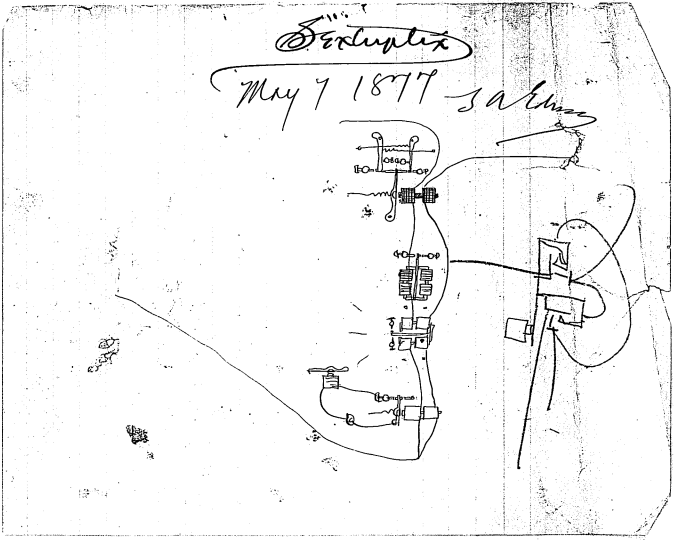
No. 24 Delvd. May 7th 1877

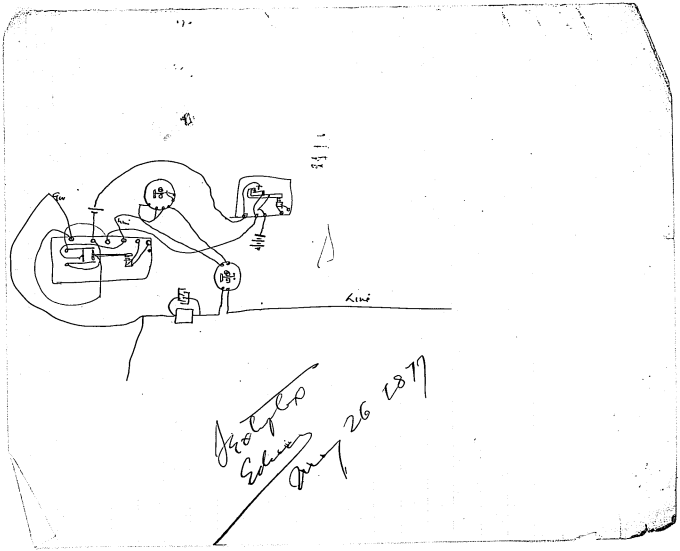

Dictyograph
May 6 1877
T A Edison
Key
Key
Key
Bell
Bell
Bell
15 Cells
100
15-Carbon
SD Cell
E

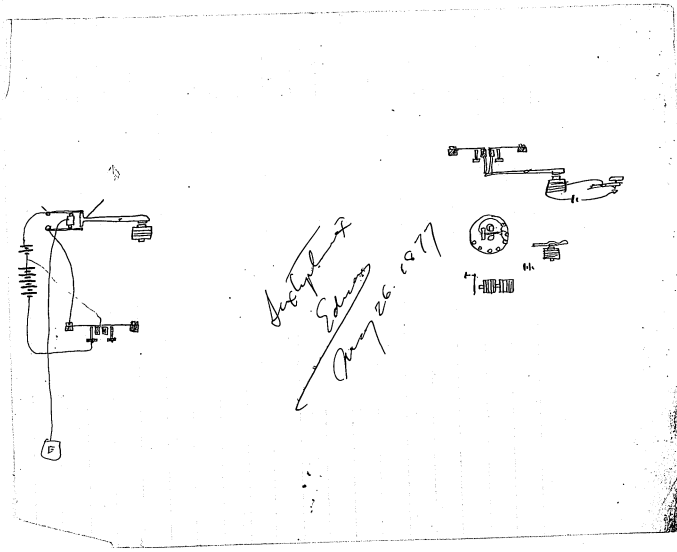

Sculptor May 6 1977
JA Edin
Rexistall
100
60 cells

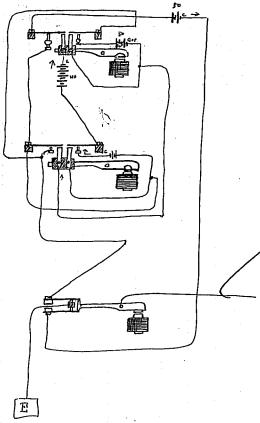
Duplex

May 7 1877





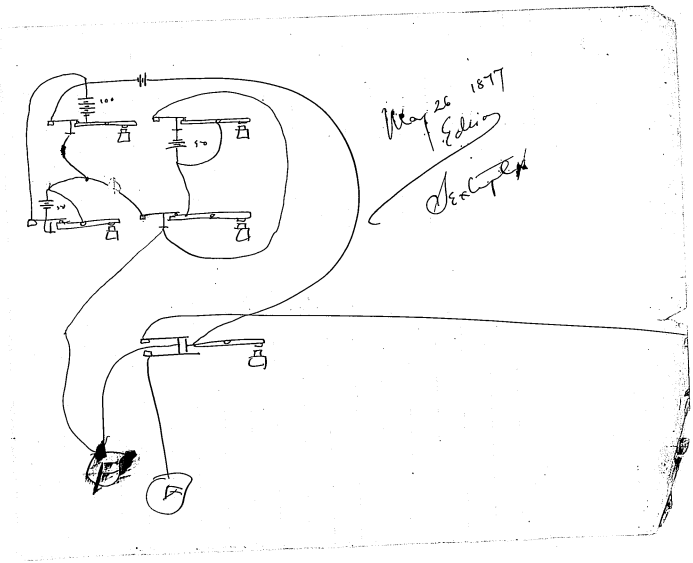

F

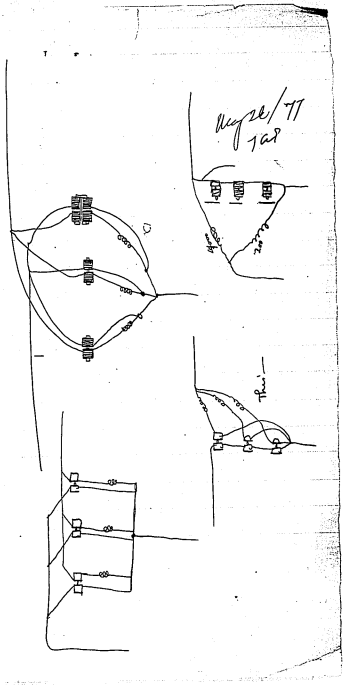


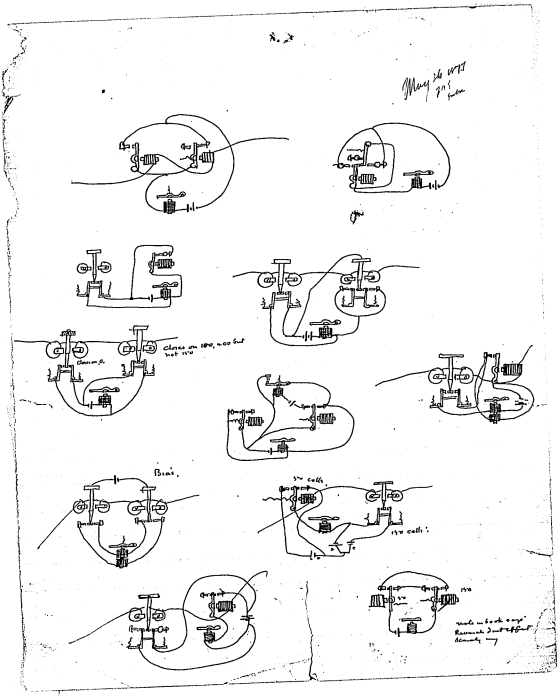
Sketch

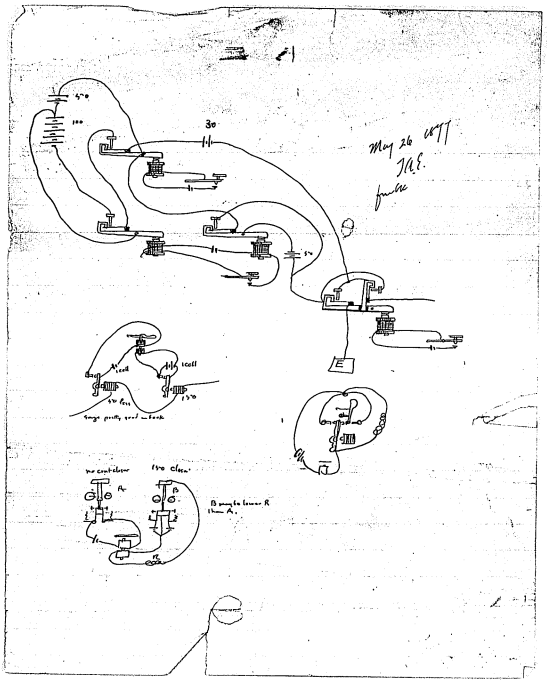
May 26 1877

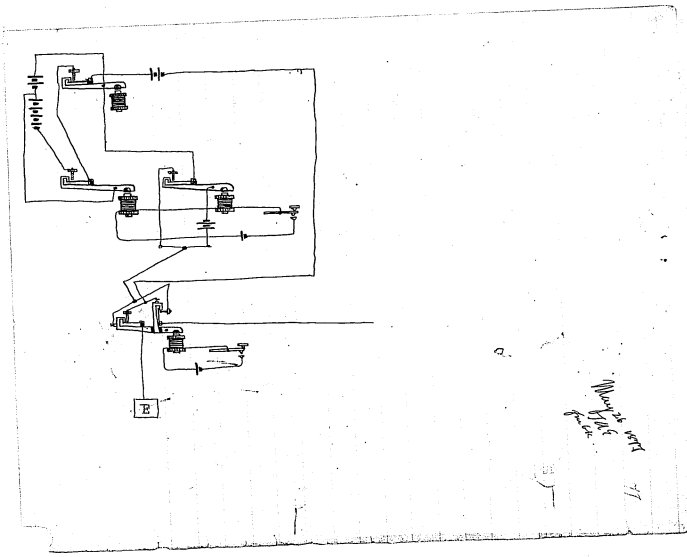
Edison

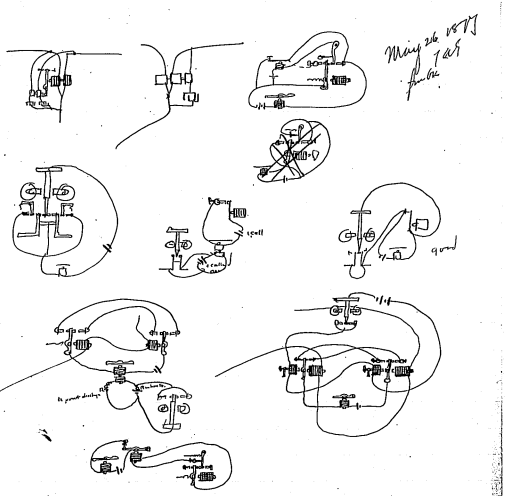

May 26 1877
Edison

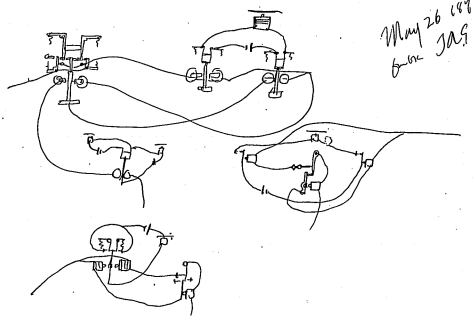



Bias.
1½ cells.
1½ cells.


4·0
100
30
May 26 1877
M.E.
E
1 coil
1 coil
two Cells
two Cells
Bring to lower R
two A's


E



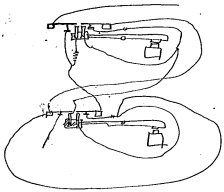

May 26 1987
Jas

Way Station Duplex

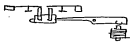
May 31 1877

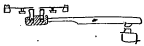
J A Brown

Thos Batchelor



Bullard





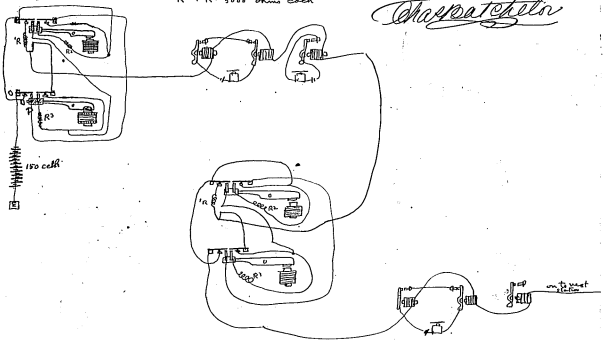
Way Station Duplex

May 31 1877

D A Gibson

Chas Batchelor

R¹ 10,000 ohms
R² & R³ 5000 ohms each

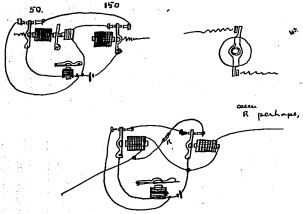


6400
3200
1600
800
400
200
12 600

1600
6400
1600
800
400
200
10000

W.U. Bldg June 6 1877 Sketches
T.A. Edison

No 1



with No 3 trains open and No 2 open I get the 50 cells of main bat with No 2 closed 3 open I get whole battery but with No 3 closed & No 2 open I get nothing I just done that now want trace it

C

No 3 Closed & No 2 Open

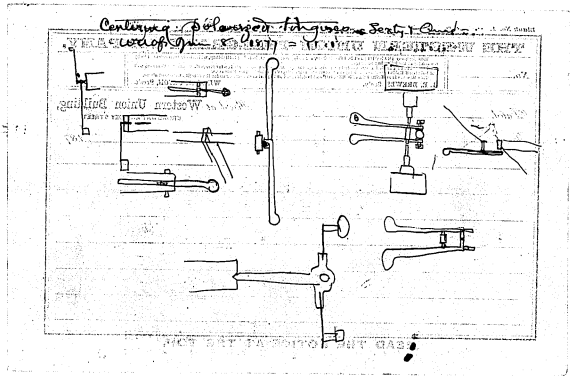
No 3 wire from the switch goes to the first thumbscrew on No 3 pole & your other wire from switch No 6 goes to 1st point in No 3 Commutator then to the pole & back via wires No. 4. and .5.

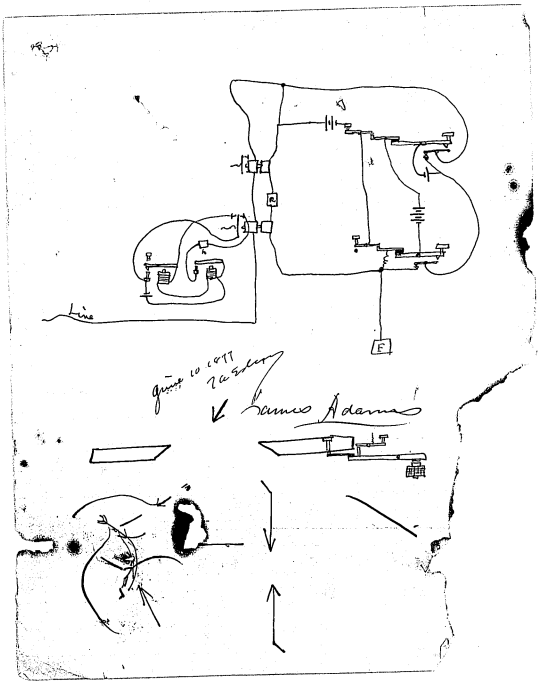
3 closed & 2 open
Nix = Both Closed
seem get whole Ball
but with 2 closed
& 3 open get
bigger Ballay.

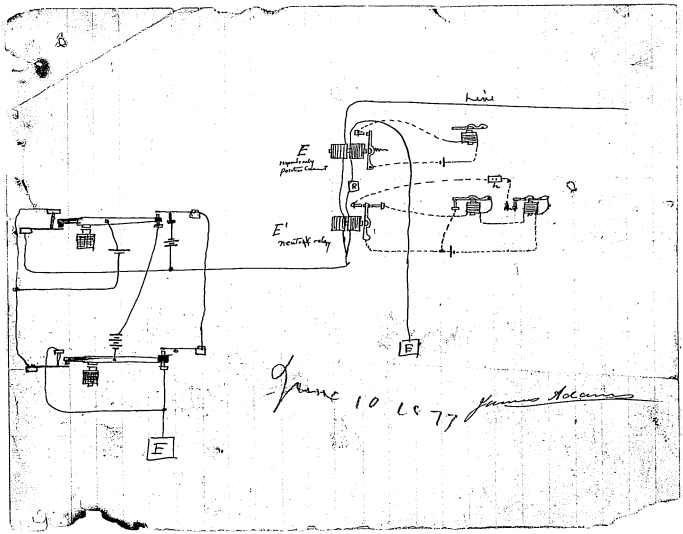
Its either on the inside
of No 2 harness ither
or on the outside of
No 3 Cears

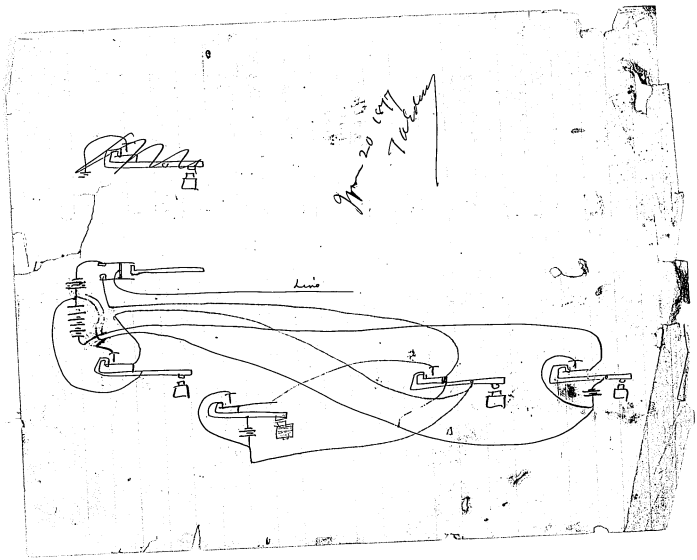
Either the wires in the
front of 3 are reversed
in their binding posts
or reversed in the inside
of No 2. or the Ballay
on No 2 is reversed.

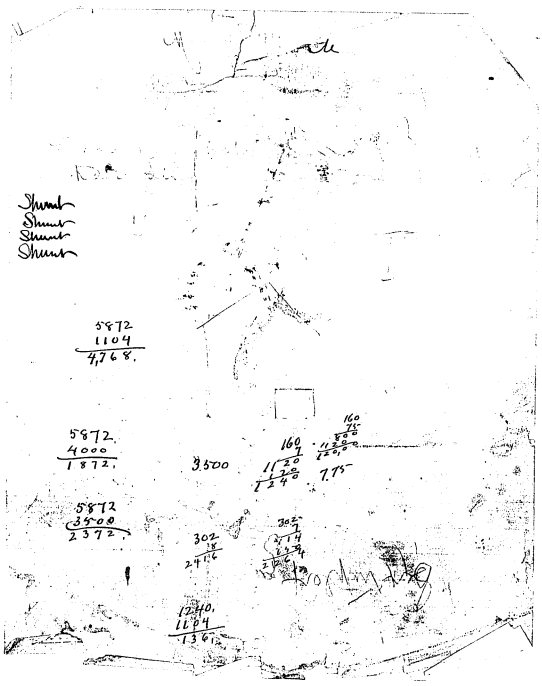
Suppose you reverse
your Ballay on No
2

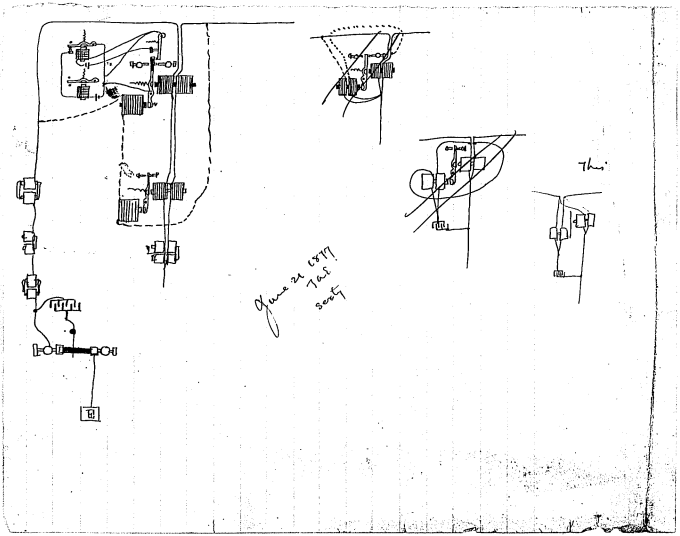



Line
E
James Adams


E
E'
E
E



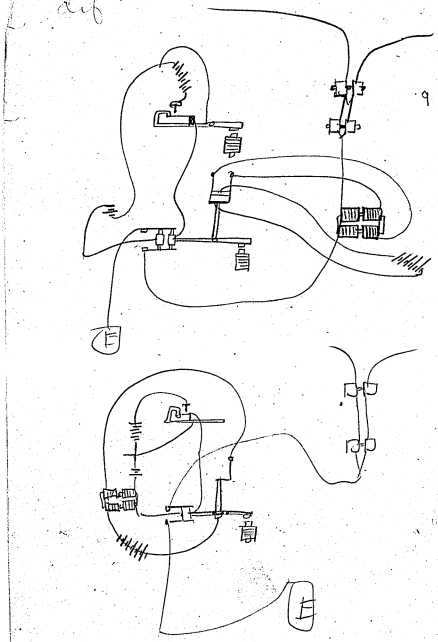

5872
1104
4,768.
5872
4000
1872.
3500
160
5872
3500
2372
302
2716
1240.
1184
136


June 21 1977
Thur
sent
Thur

Quad

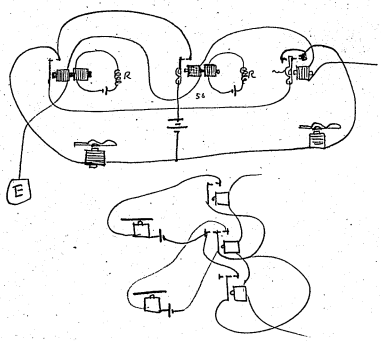
June 21 1877

Edison

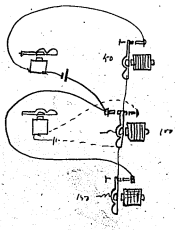


I think reversing the current through this way will increase the compensation above the old way of straight current

June 21 (87)
J.H.S.



clock

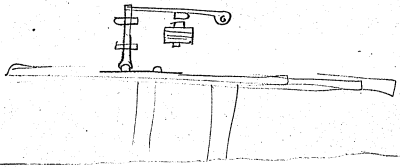


Display

Front work

June 21. 1877

How would it do to employ paper covered with plaster paris for the manufacture Embossers if you want to raise in place of indents you could raise a boss spiral & then shave them



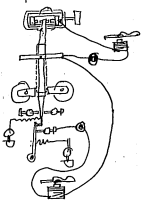
June 22 1877

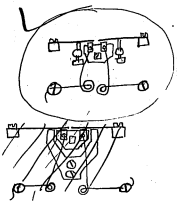
Front points on the Double relays

T. C.

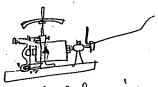
Not with the model I have Sorrell drawn them

Say that a resistance can be inserted at a or a'.

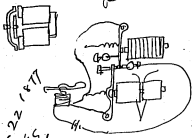




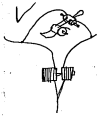
Claim a condenser made of ~~aluminum~~ insulated with dry paper or dry paper previously soaked in chemical solution which give great polarization

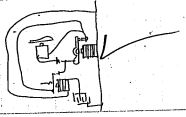


for balancing permanent magnetism

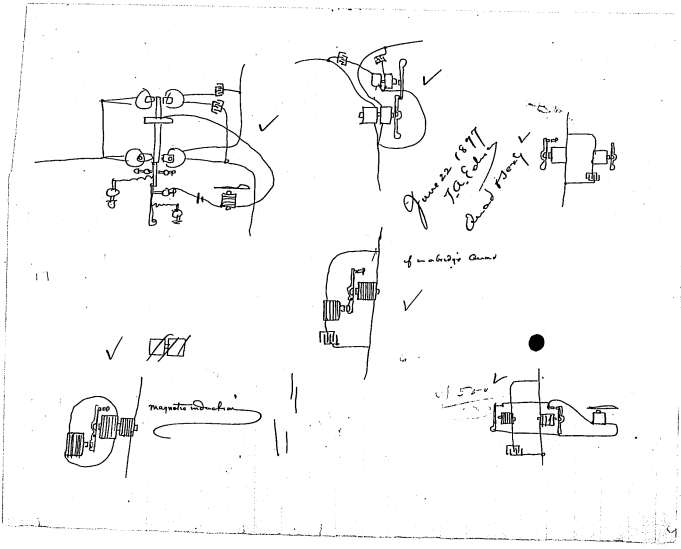


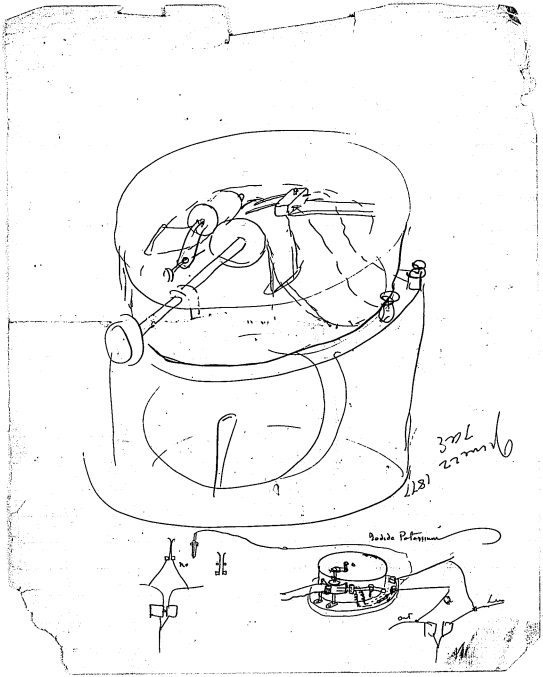
Mention that we have it of putting 1000 to 1500 ohms resistance in Condenser magnet





Jan 22 1917


June 22 1877
J.A. Fabis
Quad Point
Magneto Induction

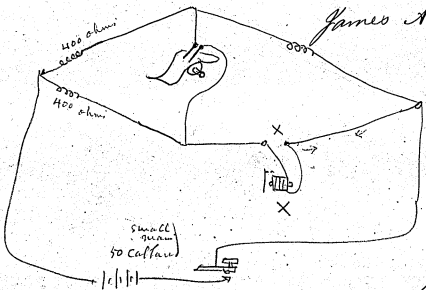

Bande Patagonne

Induction of Magnets June 25th 1877

Ground Japan.

Chas Batchelor

James Adams

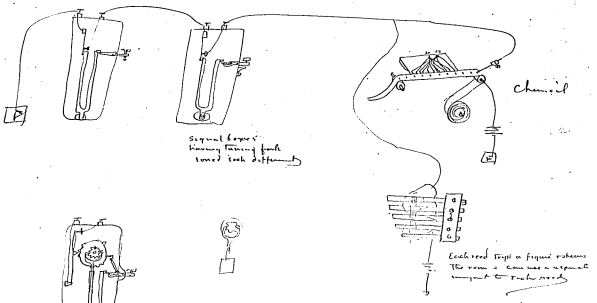


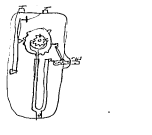
We made a Wheatstone bridge after this manner 400 ohms on each side of one end of Bridge and at X the magnet to be tested with its correspondent resistance in other side. We used 50 cells Callaud & put Automatic Instrument with double Pen in bridge wire — With a 150 ohm W.U. Relay at X and the cores touching the armature we got this:—

Aerial Annunciator
& Electrical Telegraph

June 27 1877
J.A. Edison

James Adams



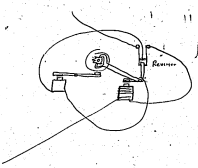


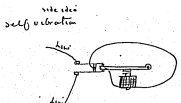
Hand Rubber of Sent gets cut in one
side & that on the other is melted
gum + Cam Glass Rubber

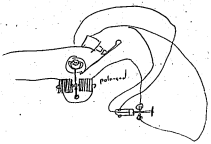
Gold & Stock Printing Telegraph

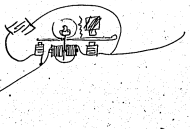
June 24 1877.
T. A. Edison

James Adams



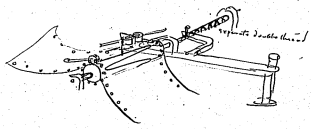




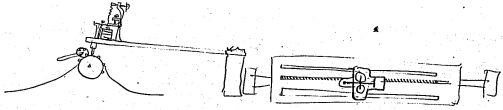


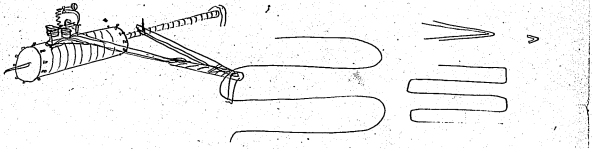
Translating Cut Roller

June 27. 1877
J. A. Edgar
Chas Batchelor
James Adams



on the Continuous roll between & proposes for obtaining accurate regulation to previously perforate holes either on both edges or on both edges with the Centre or on the Centre only, and proposes to substitute a plain with pins to pass through the perforations & ensure the feed & regulation





Pmr 6

Telegraph Reporters

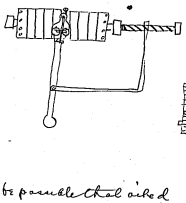
Evening Session

Monday

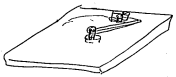
12

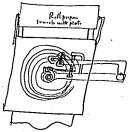
Translating Embosser

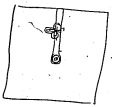
June 27 1877
T A Edison
Chas Batchelor
James Adams



It may be possible that oiled indenting paper is preferable, or that the paper should be parchment — shellacked, or dipped in plaster paris & water =





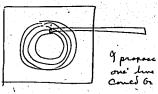


Travelling Embosser

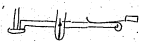
June 24 1877

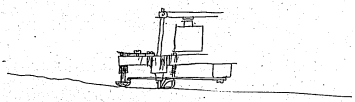
T A Edison

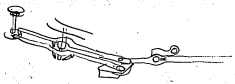
James Adams

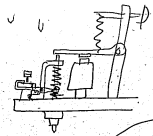


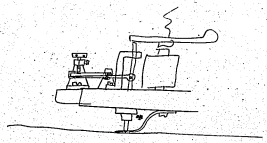
I propose in next humble to have the reversing pawls on two inside the embossing points, although I am not fixed in on two outside

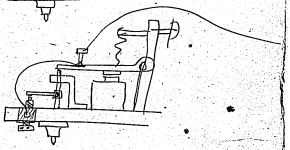


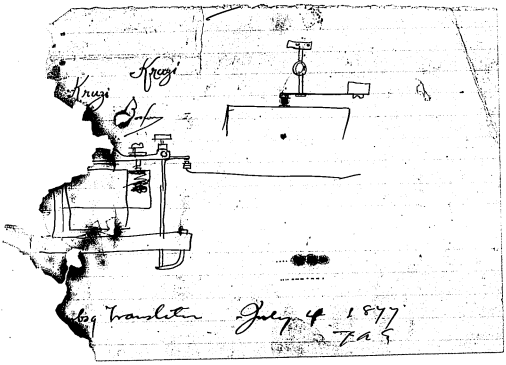








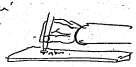



Kruzi
Kruzi
Log Translation July 4 1877

Autograph Telegraph July 5 1877.
Tissue

James Adams.

For autographic Tel write your message by embossing on paraffined paper transmit by a spring Contact



2 Write with an Electric pen & then adopt the Edison plan of graphite & sand vibrating the Contact point against the paper by a tuning fork making powerful undulations per second when no coil occurs the needle comes perpendicular to paper hence no contact & when it does occur it passes through & thus allows the Spring to come in Contact with the platina point closing the circuit.

3rd Write with a blacking ink & roll into fine dust over with plumbago & pass under a press or Ostrum rollers the will make it Conducting working use 2 pens to close circuit

by passing the mark the plumbago forms a Conductor between the pens

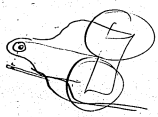
Embossing Translator July 5th 1817

To Edison

James Adams

I propose to make the graver ~~a~~ to put revealing point one or 2 lines behind indenter & open Revealing points when receiving by Letter Lever a Cam[illegible]

Coil my Embossing paper



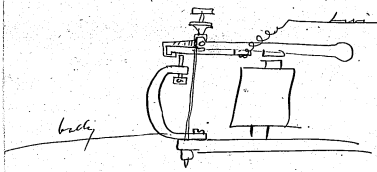
Machine oil & prepare any aleagraven embalm will answer even the gum will work by stopping the pores & all semi hard material when the paper can be impregnated with wood work = Instead of embossing in paper I can use thin Copper or other metallic foil, and I can arrange therein and Connection in such a manner that the foil will close circuit & the indentation will open by the point falling into it and prevented from going to the Bottom by a limiting pin

Embossing Translator

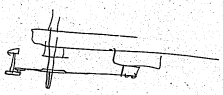
July 5 1877
To Mr Edison

James Adams

The embossing point itself may be made to repeat the retractile spring being dependent upon the lever by its own weight on the embossing point to lay on the paper when an indentation occurs it will fall down & the lever shutting a spring contact point closes the circuit



to obtain accurate repeating when it is undesirable to use the Embossing point a hole may be drilled in the Center & a needle passed down through it the needle connected to the spring & contact closes

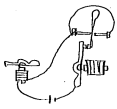


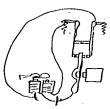
Translating Embossers

September 8, 1877
J.A. Edison

We find that Lard oil is the best thing for soaking James Adams
the paper to be indented = We have tried some preliminary
Experiments with the Continuous roll Embosser
and it looks as if it would be a success

Desk-Duplex

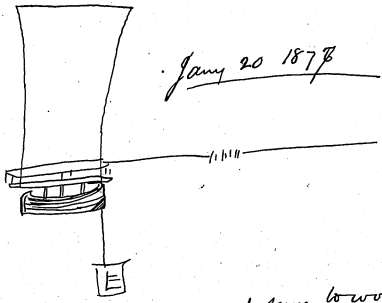




September 8. 1879.
JCA Edison

James Adams

Speaking telegraph



Jany 20 1878

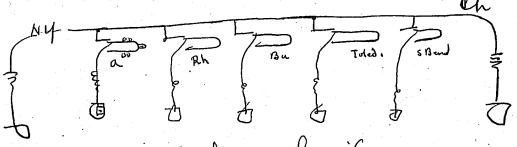
These Platina Points dont seem to work any Better than one point yet it very good on a western Union Relay Through my teeth. but I think that I can get it better if I had an adjustment to it for Charley cant Hold it steady Enough

April 10 1897

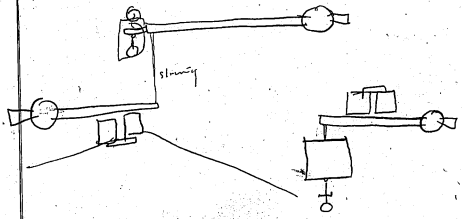
T Wrdw

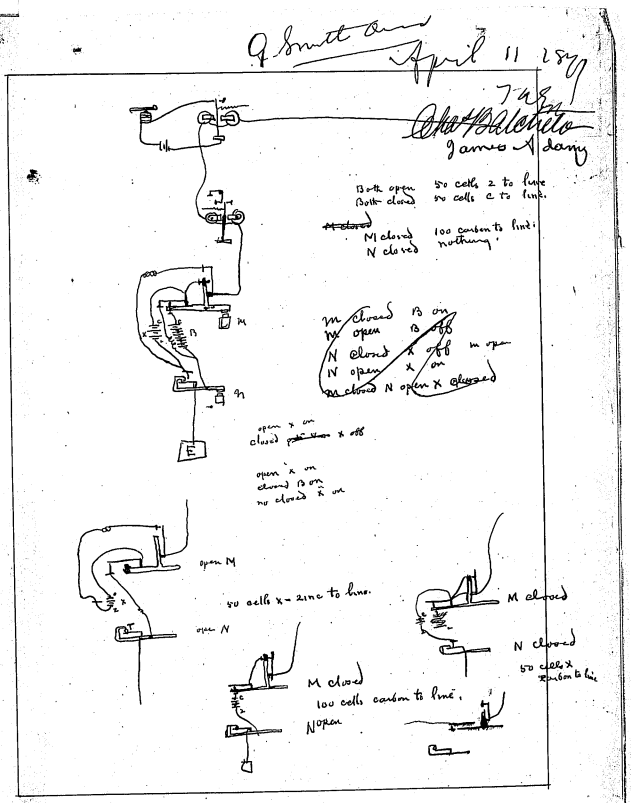
James & Lamy

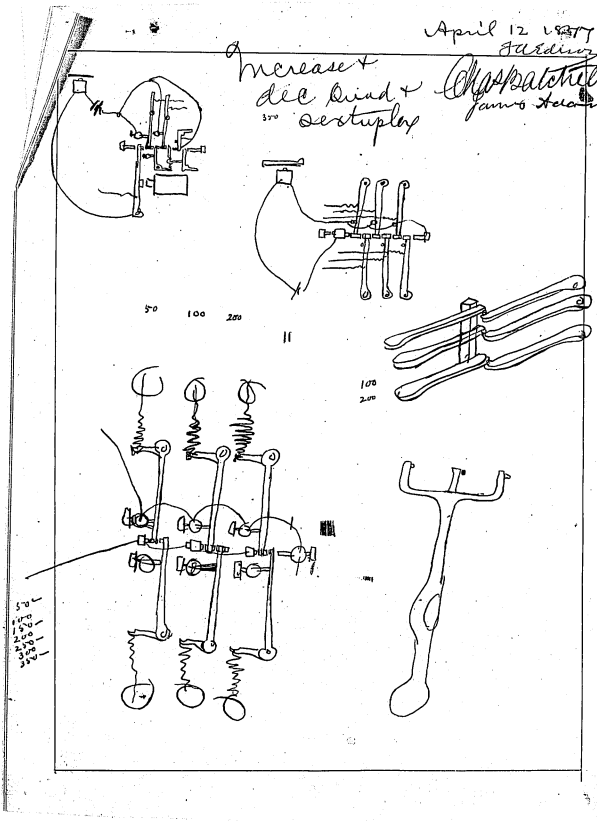
ch



discharge line by tuning forks worked by a hot cat




Q. Smith Amer
April 11 1897
Both open 50 cells Z to line
Both closed 50 cells C to line.
M closed 100 carbons to line
N closed nothing.
M
N
E
open X on
closed B on
no closed X on
open M
50 cells X - zinc to line.
open N
M closed
N closed
50 cells X
M closed
100 cells carbon to line.
N open


April 12 1937
Increase +
dec Quad +
Gastrocnemius
50
100
200
100
200

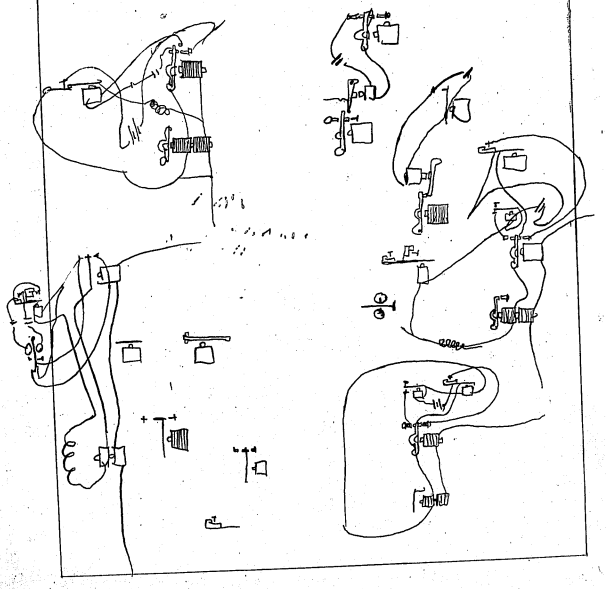
Sky Light

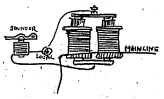
April 12 1878

T A Edison

I think rouchide on a small platina diaphram would do best thing for Esn Graph - with Acoustic

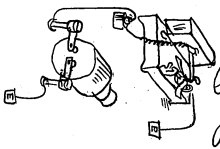
James Adams





Reverse Relay
Aug 10 1897
Thos A Edison
Chas Batchelor
James Adams

May 20 1927



Edwin
Chas Baldwin
James Adams

Photo 10 17

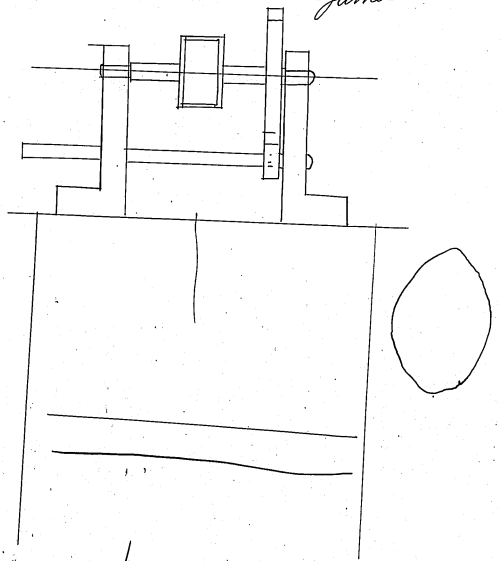
Surgery Telegraph

May 28 1877

Edison

Geo Gatchell

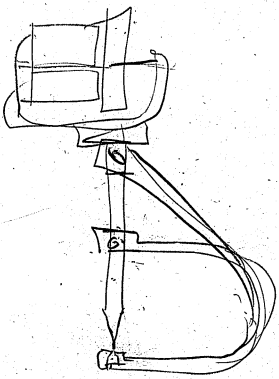
James Adams

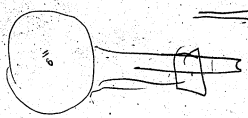


1878. General (NS-78-001)

Pen

Feby 6 1878
T. A. Edison

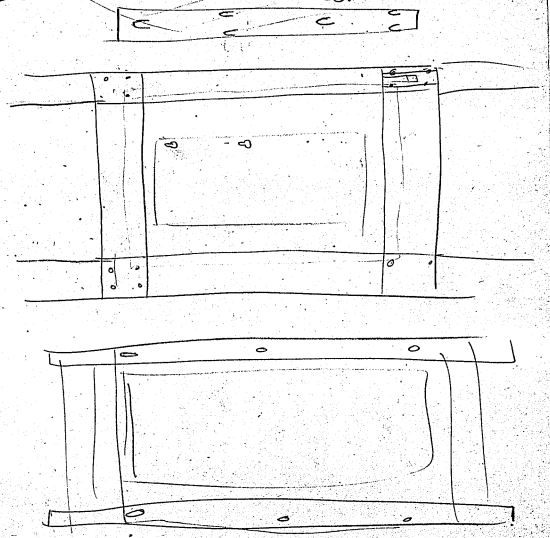




Rotary Press

Feb 28th 1975

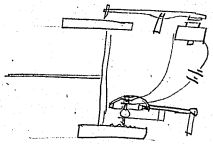
Chattahoochee



April, 10. 1878 –

Electric Engraving Machine

T. A. Edison



June 6th 1878

Chas Batchelor

When I cut a piece of Camphor long and rub a piece of Sulphur ~~or sealing wax~~ and present it ~~at~~ with it long axis across and at right angles to the long axis of the piece of Camphor the piece of Camphor will immediately change its position taking a position parallel a piece of sulphur

When small pieces of Camphor are placed on table and a rubbed piece of sulphur ~~sealing wax~~ presented they will jump 1/2 inch up to get at the Sulphur

Sulphur rubbed has a much stronger influence over floating Camphor than Silica or rubber

Sulphur rubbed and held close to water surface attracts at 3/8 of an inch the water which instantly leaves it again without wetting it

It attracts equally well in the middle and both ends

June 6th 1893

Camphor in small lumps Quadrangular floating in water: when you present a piece of Sulphur that has been violently rubbed on my coat ~~presents it~~ ~~polarity to the camphor and~~ is attracted ~~same~~ violently ~~as I presented~~ ~~the Sulphur to the other end of the~~ ~~piece of camphor it would not attract~~ ~~till the pole nearer them it~~ ~~would follow the Sulphur~~ ~~Lycopodium in water is strongly attracted by Sulphur~~

Also polarize being attracted to one end of piece of Sulphur when the other end of Sulphur presented it repelled & went to the other pole

W

July 6th. 1898

Chas Batchelor
Martin H. Fox

Camphor and Sulphide of Antimony are violently attracted by rubbed Hard Rubber, Shellac and Sulphur

Paraffin is attracted by Sulphur & rubber etc When rubbed

Positive and Negative electricity both attract Camphor.

In the needle experiment on the water Positive and Negative electricity both attract the corks but repel the needles.

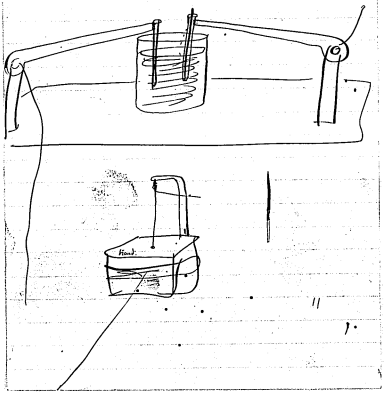
Gehäusemaße:
Klein Profil N
Form 28 15/1
Schnitt

T. A. EDISON,

Menlo Park, N. J., 187

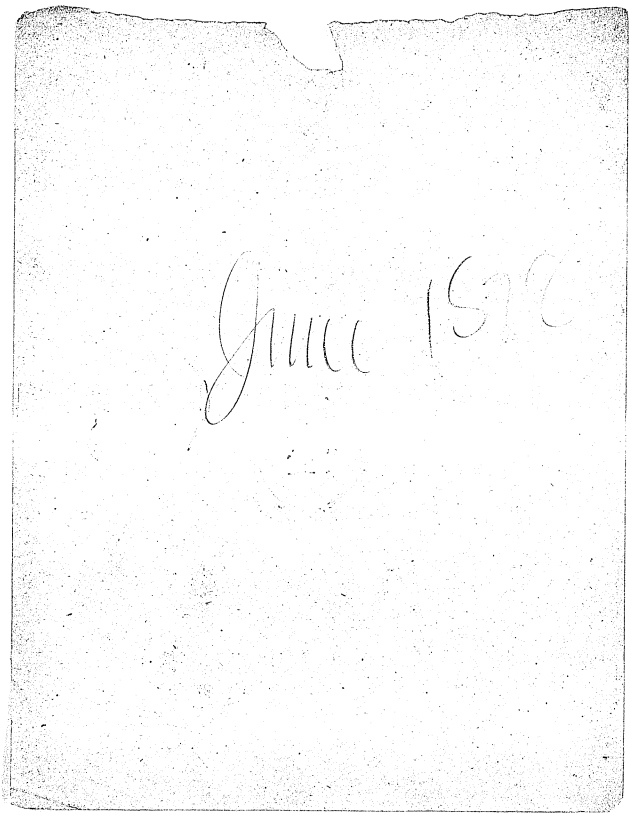
Palaroma

June 21 1878

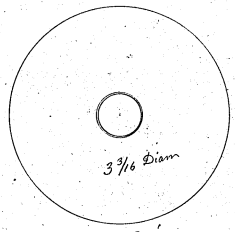


Carbon Rheostat — Secretaire aussi —
Jaumette Secretaire aussi —
Mon ou my express, —
Megaphone, my express;
Dictaphone Interpreter — my express
Mon Periscope — her express;
Phonograph — my express
Current Governor; — her express
Microphone, my express
Aerophone, they express
Musical Telephone Her express;
Harmonic Engine; Secretaire aussi
Spy Telephone for aeroplane
Ear & spy Telephone;

Prescott Cook


June 1918

No. 1 Galvanometer July 5th 1838



H pierced

T. A. EDISON.

Menlo Park, N. J., July 21st 1875

Mr Kruesi

Have Andrews make
(6) six boxes for battery for
(2) two cells of Watson each
You will find some of the
fastenings for them in one
of the drawers under the
showcase

Batchelor

O.K. except 6 Binding posts

July 31st.

T. A. EDISON,

4

Menlo Park, N. J., July 27th 1875

John Kruesi,

Make (1) One box for
Fluffo. to hold (350) three hundred
& fifty

Chas Batchelor

O.K. consisting of seven (7)
small boxes with sliding covers
and one (1) outside box to
receive them all, cover to
screw on

J Kruesi

1178-67-27

T. A. EDISON,

Menlo Park, N. J., July 27 1878

5

John Kruesi.

Make a carbon pressing die and a press & send to Paris to Adams also double cases for same for shipping

Chas Batchelor

O.K.

Completed and shipped to Baldwins ameex & european express.

Augt 8th 1878

J Kruesy

T. A. EDISON,

Menlo Park, N. J., July 27 1878

6

John Kruesi

Make one Carbon-silk resistance box like last made, but with cable on side

Chas Batchelor

Completed Augt 8th 1878

J Kruesi

T. A. EDISON,

8

Menlo Park, N. J., July 30 1878

John Kruesi

Make (1) one trough for electroplating about 24 x 12 x 10 rabbetted & bolted together.

Chas Batchelor

Finished July 31.

J Kruesi

T. A. EDISON,

9

Menlo Park, N. J., July 30 1878

John Kruesi

Make a number of straight steel bar for magnets of same size to determine the best for magnetism

Chas Batchelor

E L

9

T. A. EDISON.

Menlo Park, N. J., _____ 187

Mr Kruesi

Well you please make a new diaphragm for this, same as it had before I cut it. don't spoil this one as I want to use it please make it at once I want to take over early

Batchelor

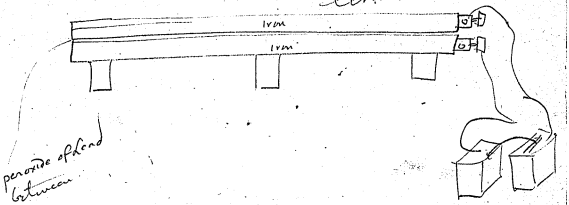
finished Aug. 28. 1878.
J Kruesi

Heating by Electricity

Aug 27, 1878.

T A Edison

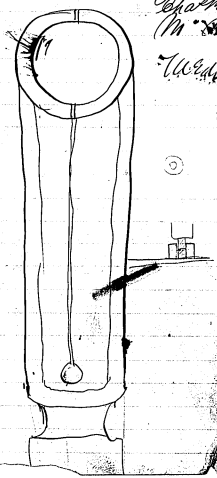
Charles Batchelor



T. A. EDISON.

Menlo Park, N. J., Aug 30th 1878

J Kruesi
Charbatchelor
M [illegible] Force
T A Edison



T. A. EDISON.

Menlo Park, N. J., Sept 14 1878

Kruesi Make another battery like the one for the Little Engine as soon as you have time
Batchelor

T. A. EDISON.

Menlo Park, N. J., Oct 9 1878

J Krusi
Chas Batchelor
Geo Gorman
M M Force
Mae

Personally appeared before me this day of 18 , the said Thos. A. Edison, Chas. Batchelor, John Krusi, and Martin Force, and acknowledged the above to be their signature

Notary Public.

Portland
Portland
Portland
Portland
Por

T. A. EDISON.

T A Edison
Menlo Park, N. J., Oct 8 1878
Chas Batchelor
J Krusi
Geo Gorman
M M Force

Electro
Expansion Engine,

Personally appeared before me this day of 18 , the said Thos. A. Edison, Chas. Batchelor, John Krusi, and Martin Force, and acknowledged the above to be their signature

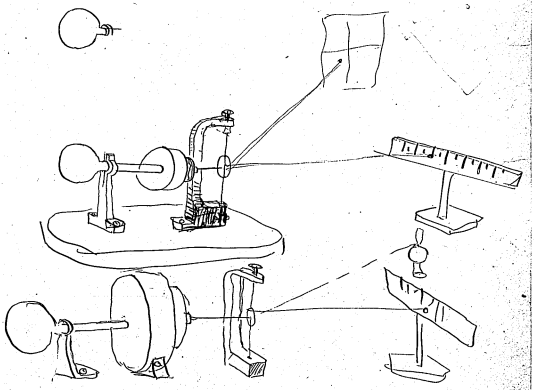
Notary Public.

Oct 18 1898

J. Hruska
M. A. Power
Characteristics
Ta Edison

#23
9 4

1 - 10
20
61



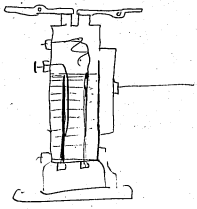
New Rochelle Oct 18. 1878

J Hewitt

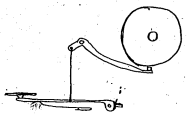
M. M Force

Chas Batchelder

T A Edison



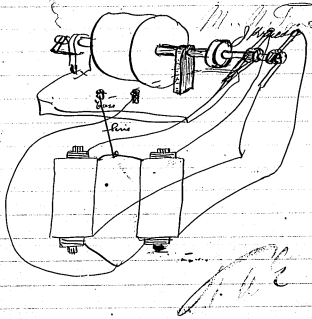
Perforating tape Wheatstone
Nov 29. 1878

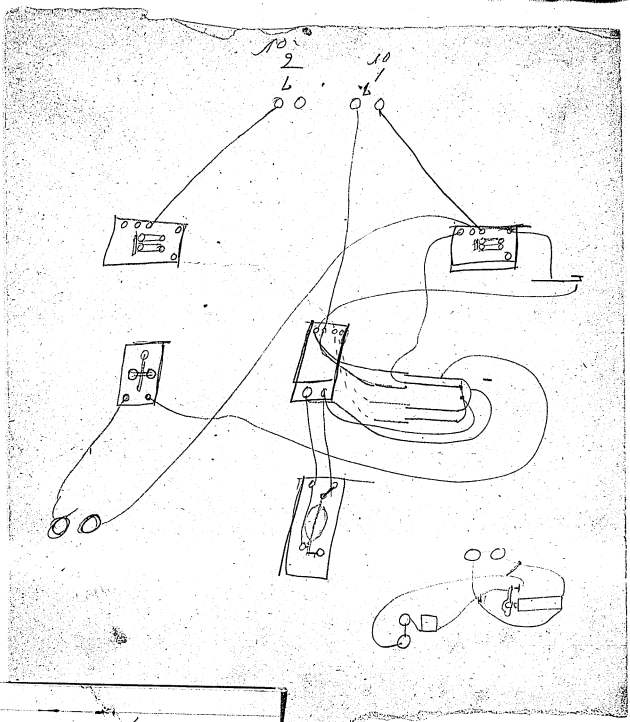


T. A. EDISON.

Menlo Park, N. J., Oct 21st 1878

WC
Characteristics

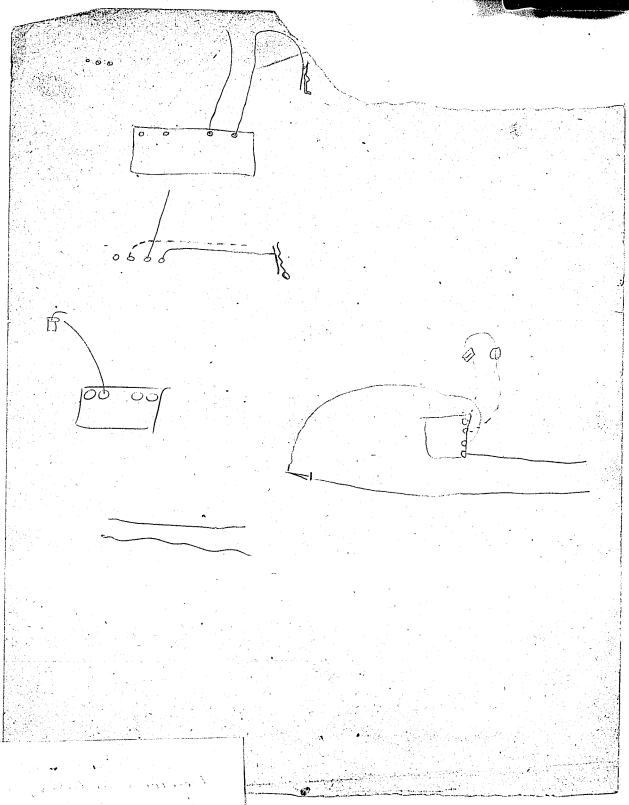


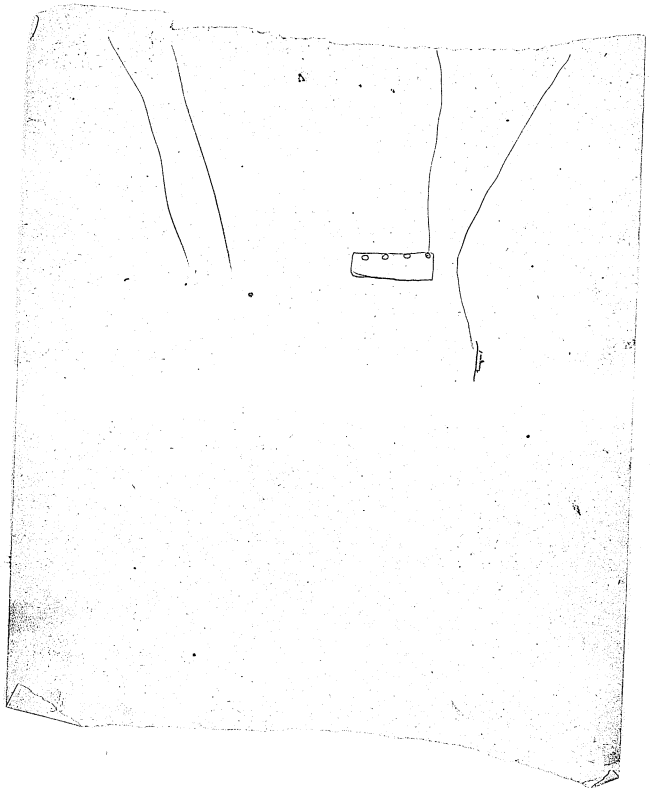


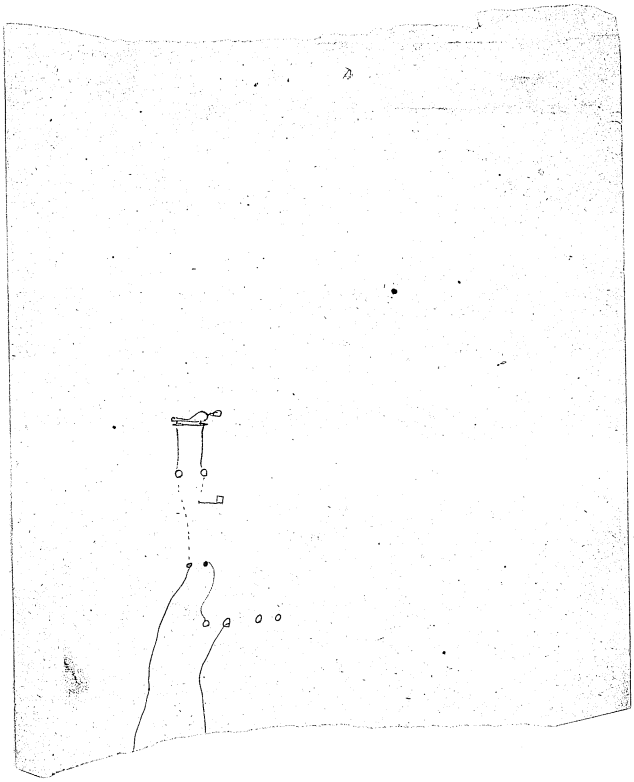
These were not taken from our Book but bear no dates or signatures. my opinion is they were drawn by Alex Graig

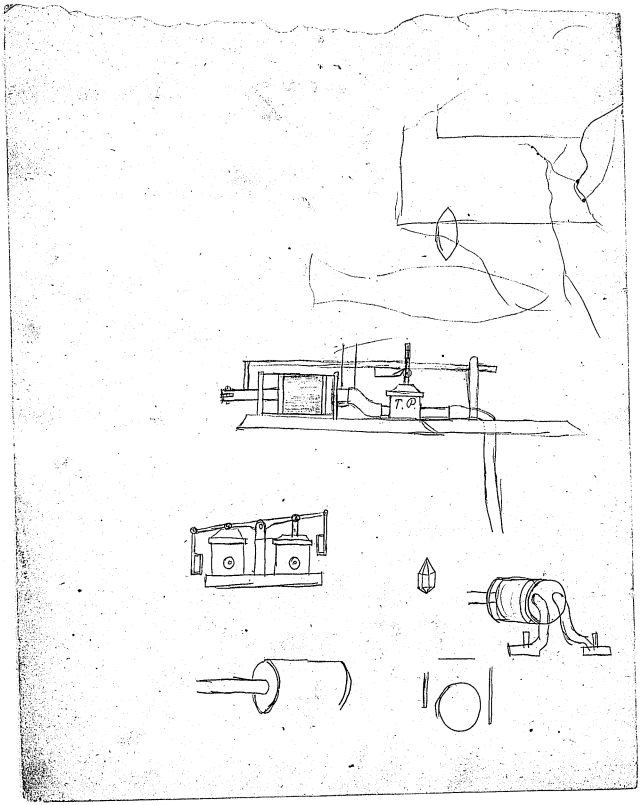
ate

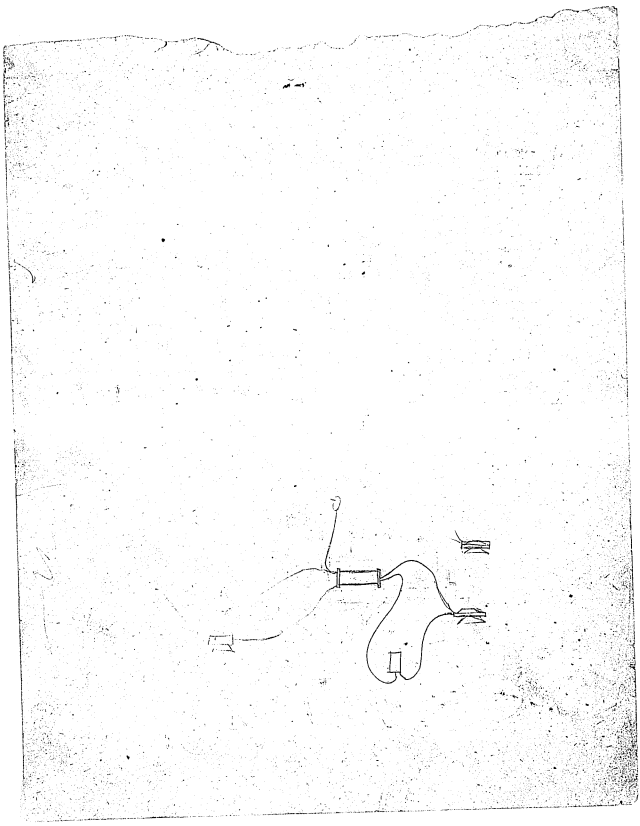
Sept 24, 1898

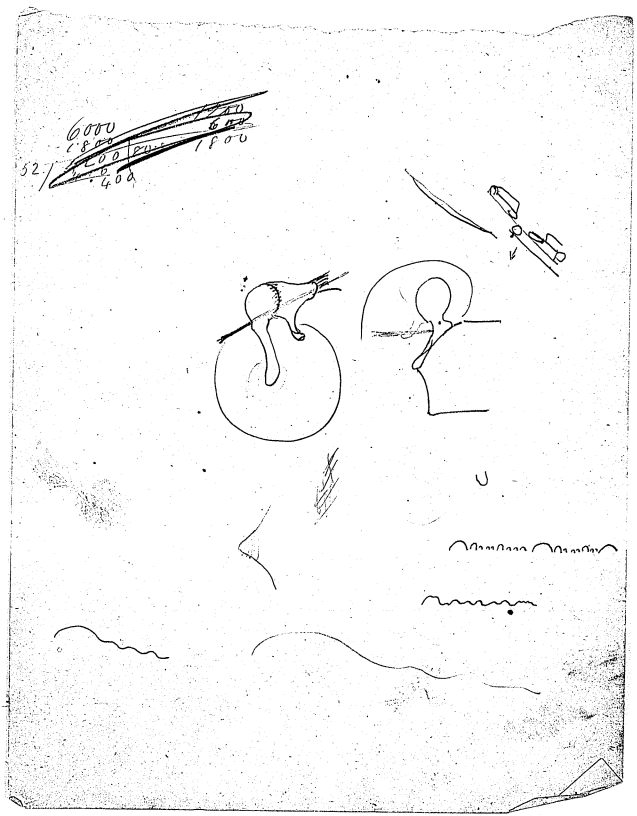


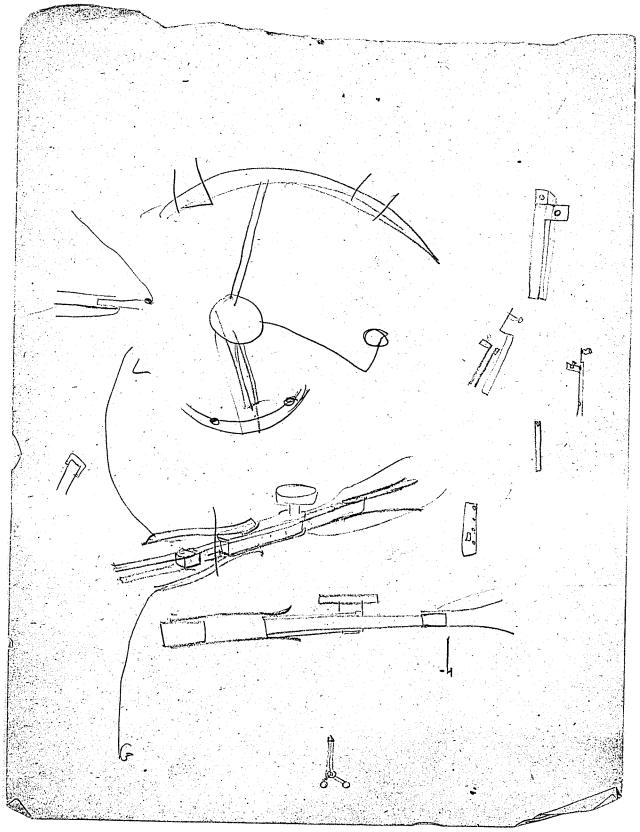


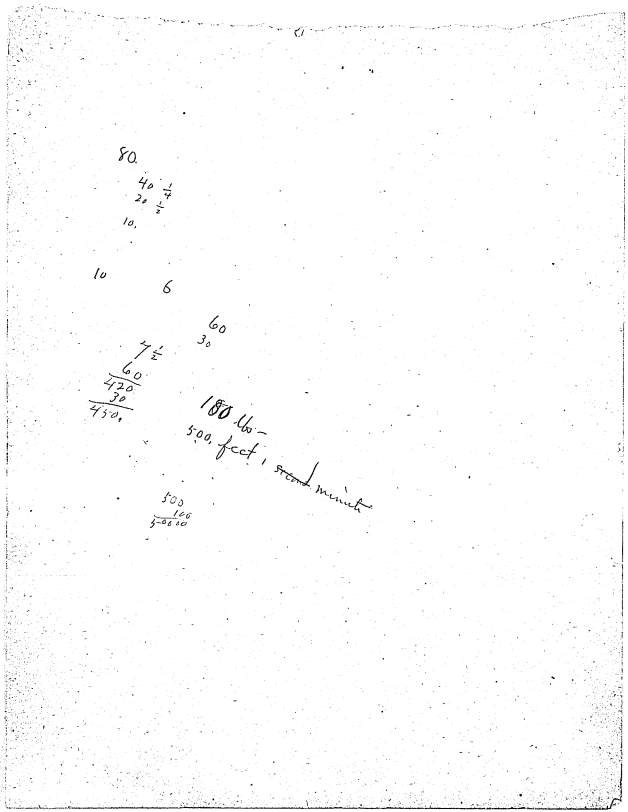


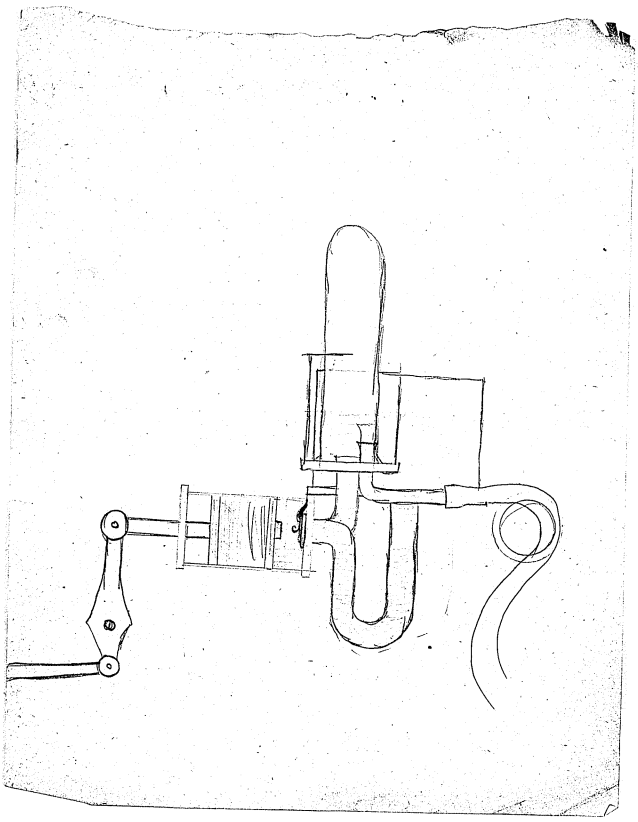


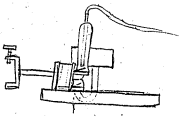


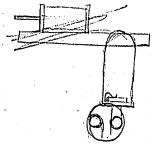

6000
1800
1600
1400
52

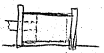


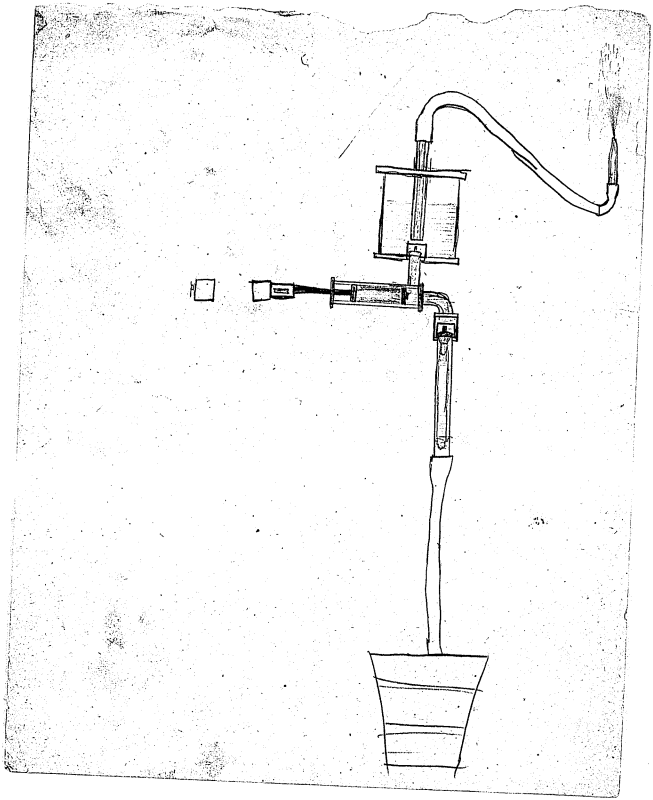

80.
40 1/4
20 1/2
10.
10
6
60
30
7 1/2
60
420
30
450.
180 lbs.
500. feet, 1 second minute
500
100
5=810

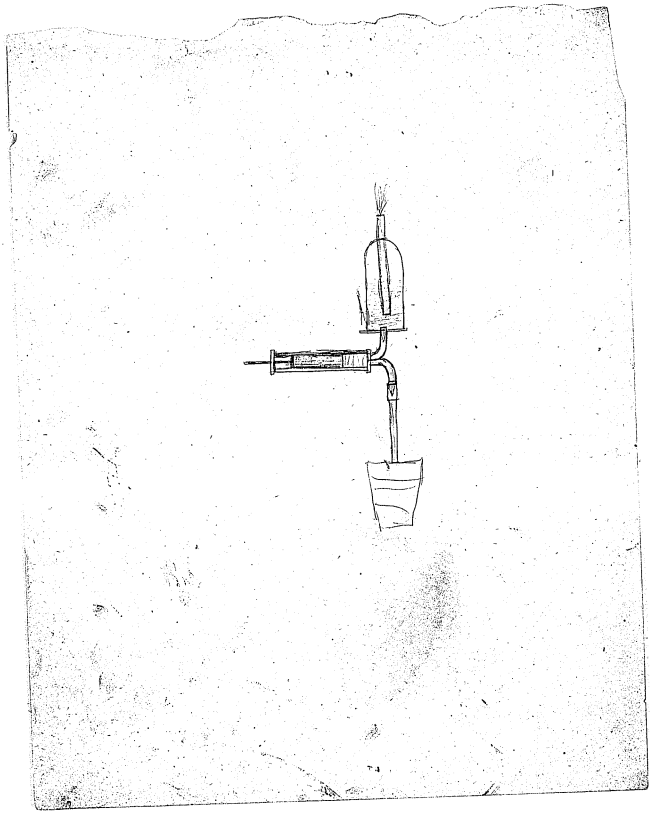


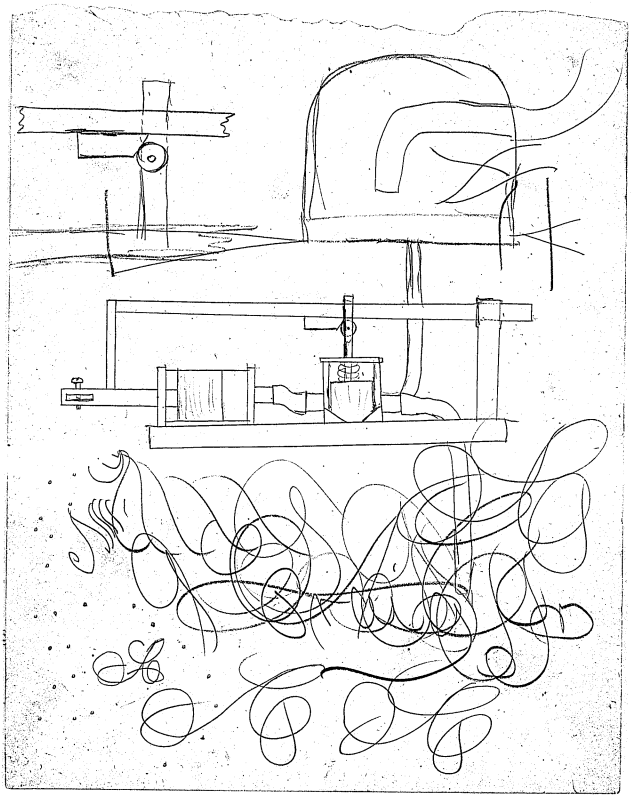






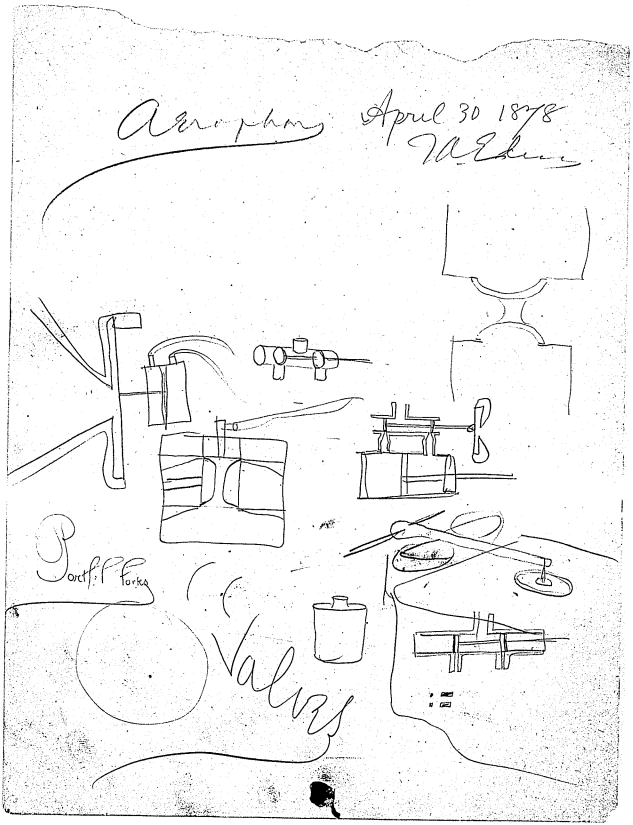


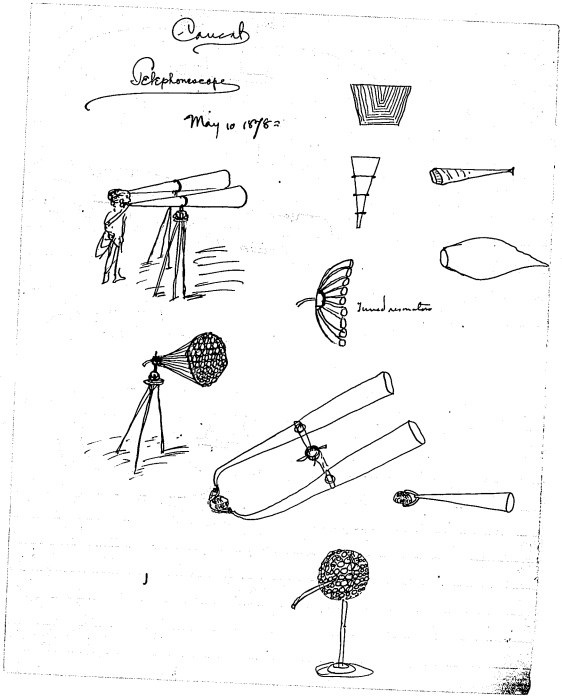




1878. Acoustic Devices (NS-78-002)

See also : "1878. Voltameter" (NS-78-012).


Aerophone April 30 1878
T. A. Edison
Port. Force
Valve

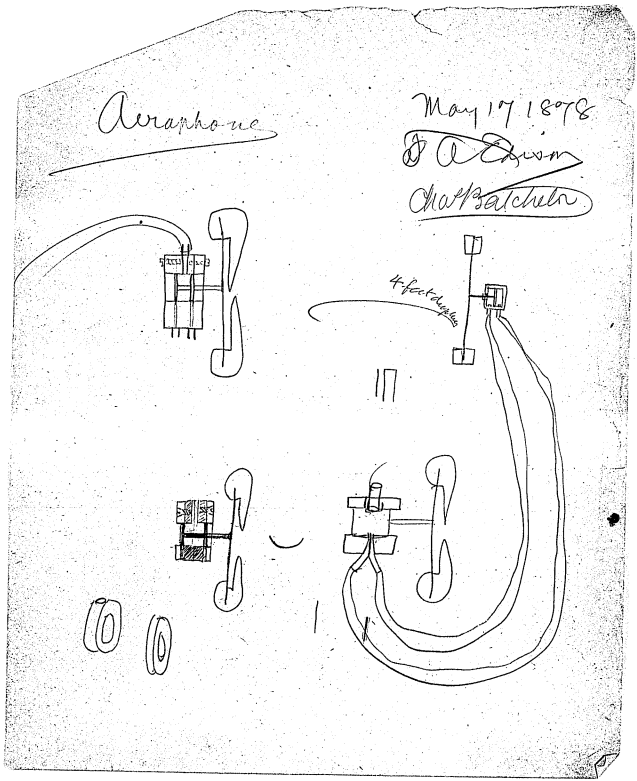

Telephonoscope
May 10 1878

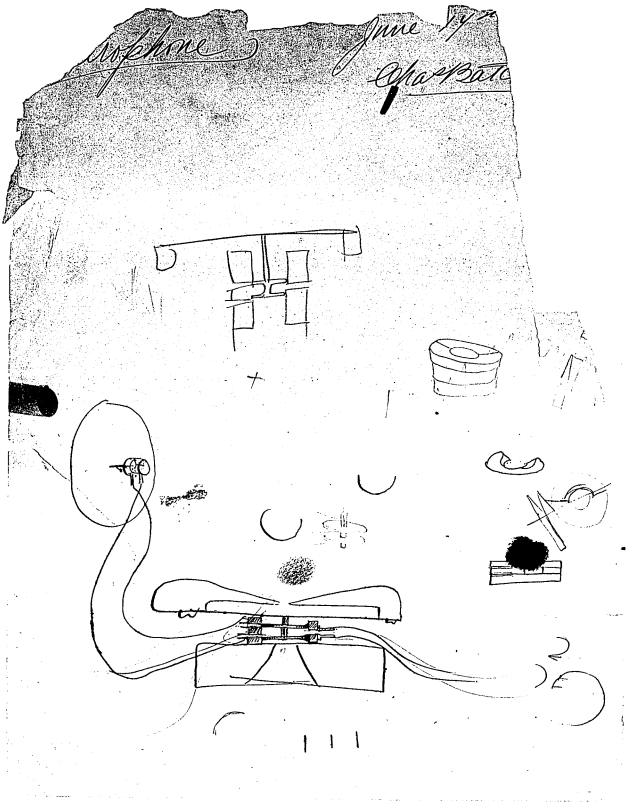
Aeraphone

May 17 1878

D A Edson

Chas Batchelor




Telephone
June 19
Chapman

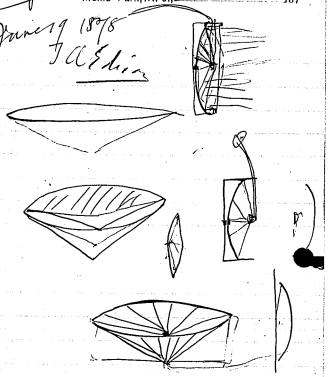
T. A. EDISON.

Aerophone

Menlo Park, N. J., ... 187

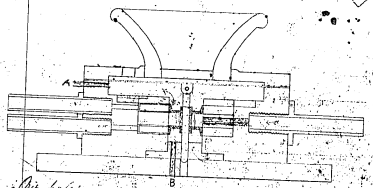
June 9 1876

T A Edison

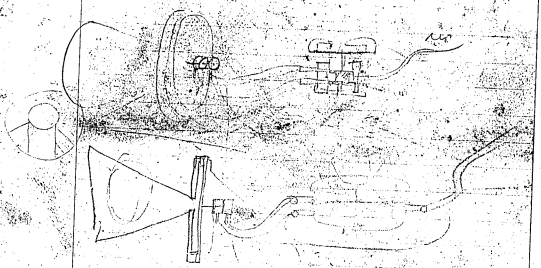


Valve for "Aerophone"

June 21st 1878 Charles Wheatstone John Penn



A,B. 3 Chs Wheatstone



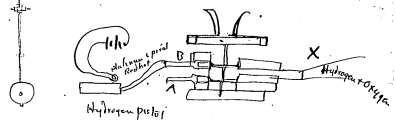
June 21 1878

Chas Batchelor T. A. Edison

J. Krusi

C. E. Cameron

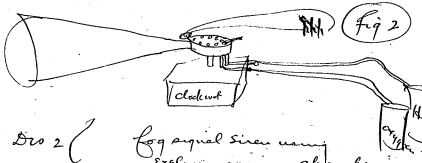
Fig 1 M. M. Stone



Des 1

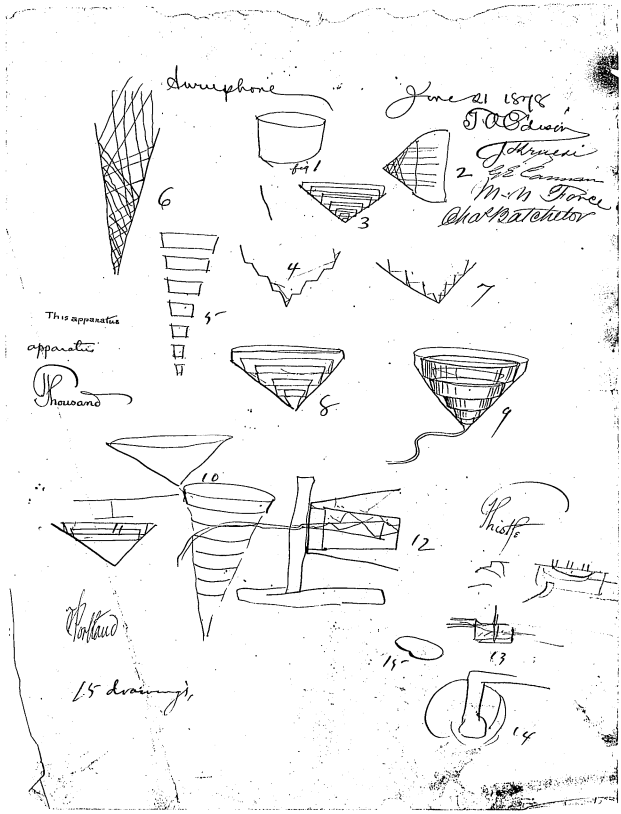
May arrange it to let H. pass in B & Oxygen in A. + use X for pistol.

This will dispense with diaphragm and cylinder



Des 2 Fog signal Siren using Explosive gases in chambers

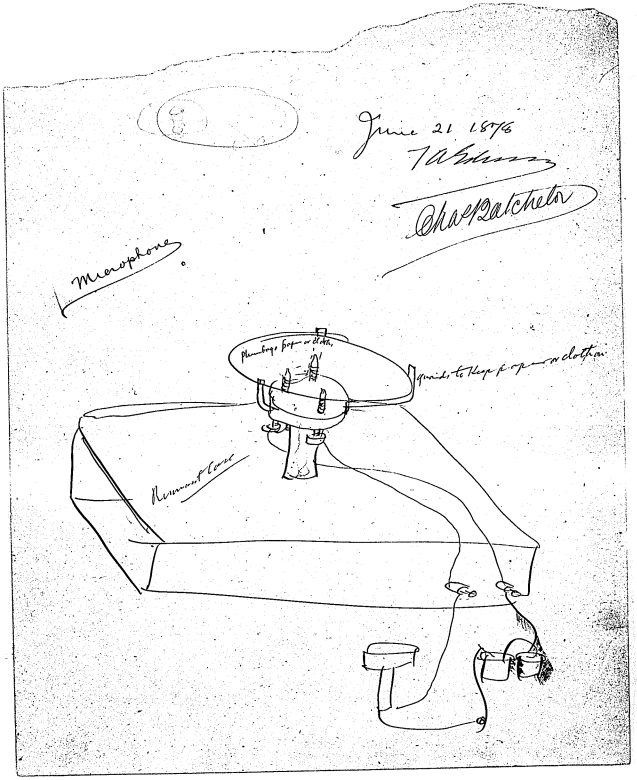
The Chambers are filled automatically & Explode by hot spot. So they come off with funnel like coils & valves =


duruphone
June 21 1878
T A Edison
Jehu Eyes
Geo Cameron
M-M Force
Chas Batchelor
6
1
2
3
4
5
7
This apparatus
apparatus
Thousand
8
9
10
12
Phisiff
Portland
15 drawings
13
15
14

June 21 1876

T A Edison

Chas Batchelor

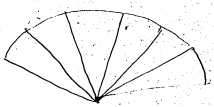


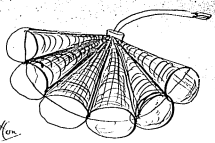
Aurophone

June 21 1875

T A Edison

Chas Batchelor





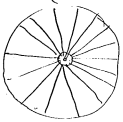
Push button

Push Button

Megaphone or talking Aurophone

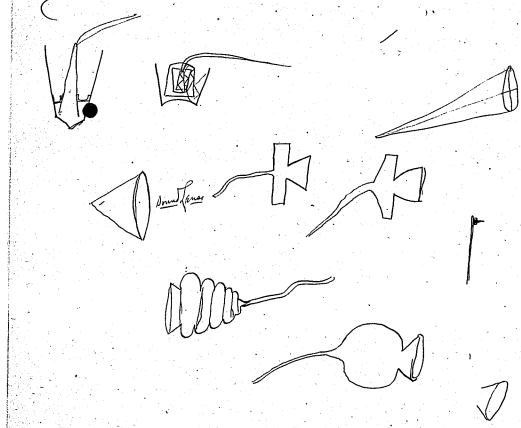
Resonator

Diaphragm of Gum



Auriphone
for the deaf

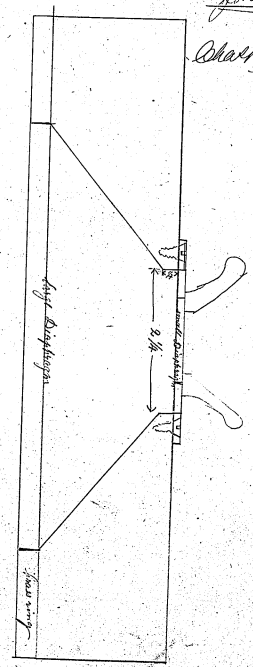
June 22 1878

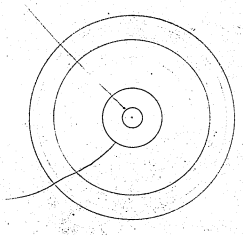


Magnophone June 22d 1848

J. Reese

Chas Batchelder





Cornophone

June 23 1878

T A Edison

Chas Batchelor

Martin N. Force

J Krusi

F B Campbell

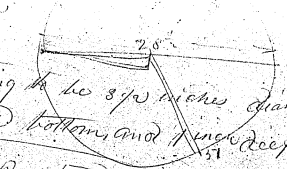
M. N. Force

Rule for making cone

Cone to be 16in at mouth & 1 aper to nothing 12in deep

Strike a circle 14th radius measure off 51 inches on circle and

Shape of rings for cone.



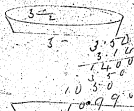
1st First ring to be 8 3/4 inches diameter on top 3 inches on bottom and 1 inch deep making 9 3/4 inches

2d Second 6 3/4 on top 6 on bottom 6 5/8

3rd Third 9 1/4 on top 9 on bottom

4th Fourth 12 1/4 on top 12 1/8 on bottom

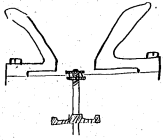
5th Fifth 15 3/4 on top 15 on bottom

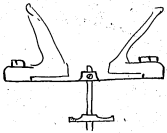


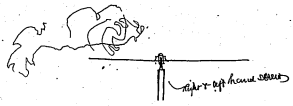
Aero Shore

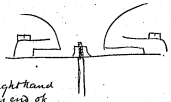
28-2 6648

Chas Baldwin





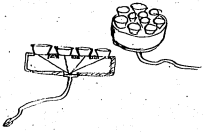


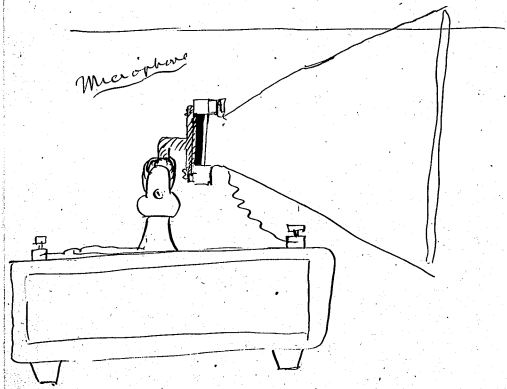


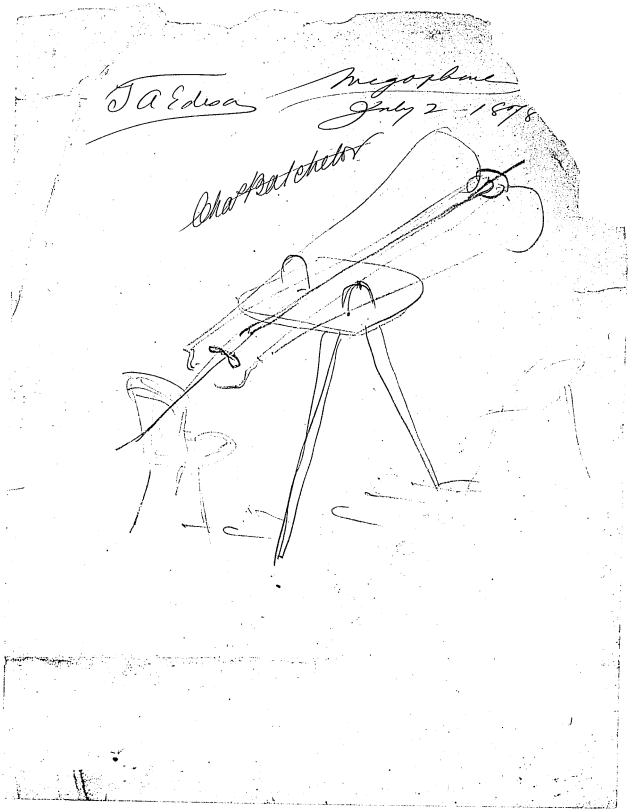
Bent right hand thread on end of rod screwed into brass upper knob on staff and screw driven set in top of same.

Deaf
Aurophone

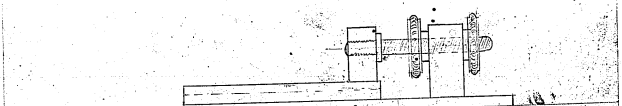
June 29. 1878
T A Edison






T A Edison
Megaphone
July 2 - 1878
Chas Batchelor

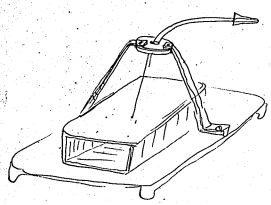
Chr. Crane July 3d. 1838
J. Linnell

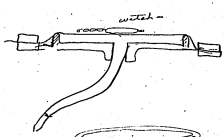


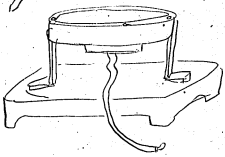
Mechanical

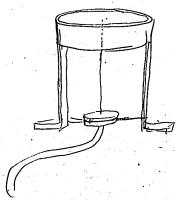
Microphone

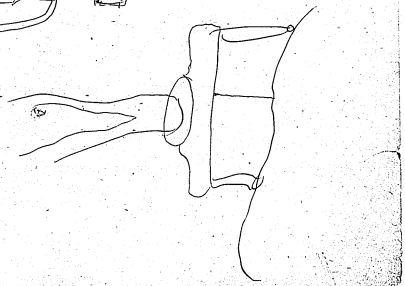
July 6 1878

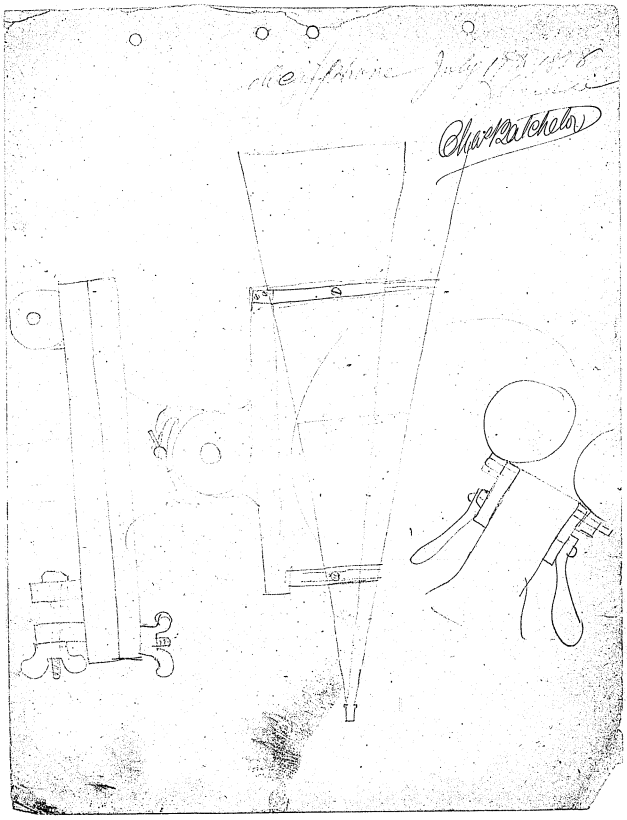






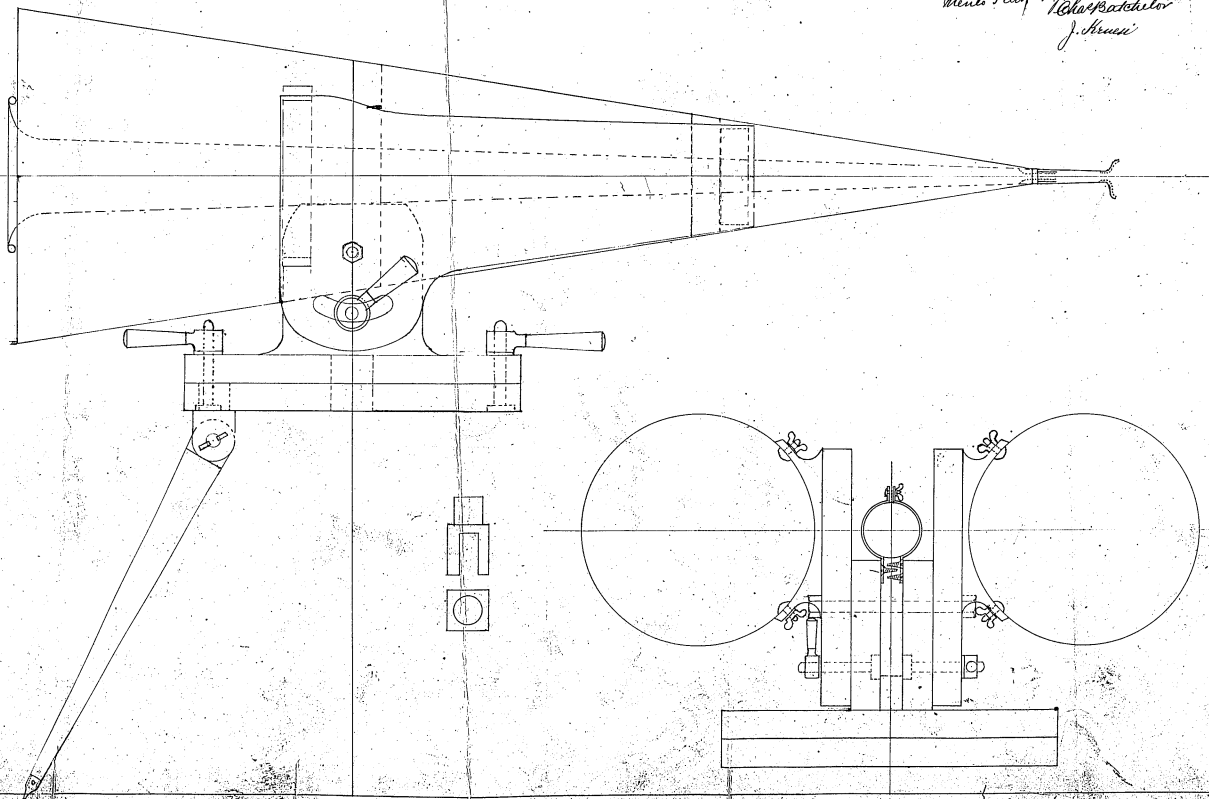


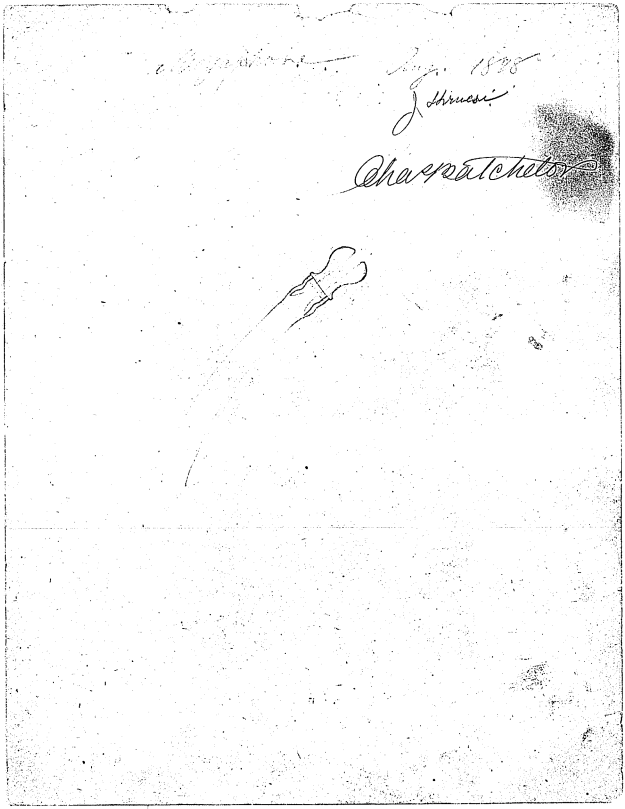


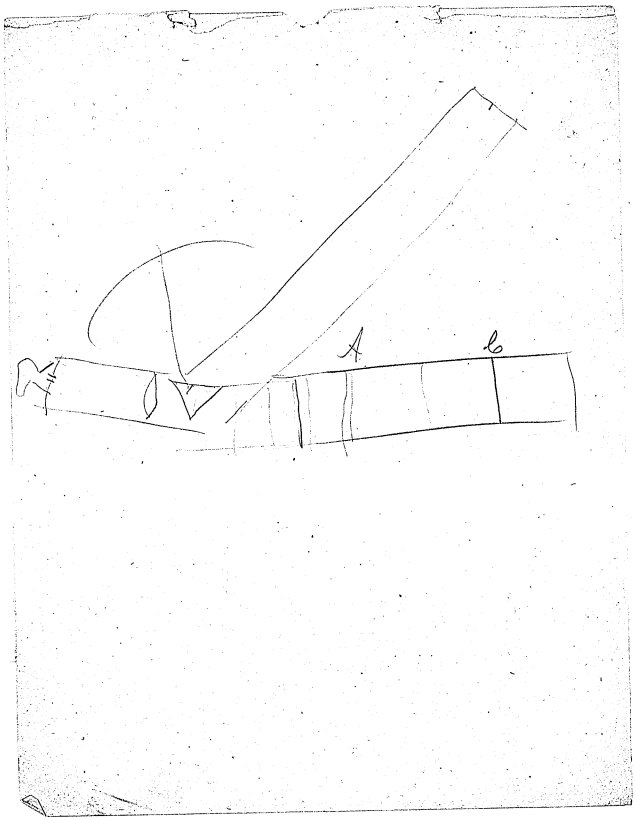


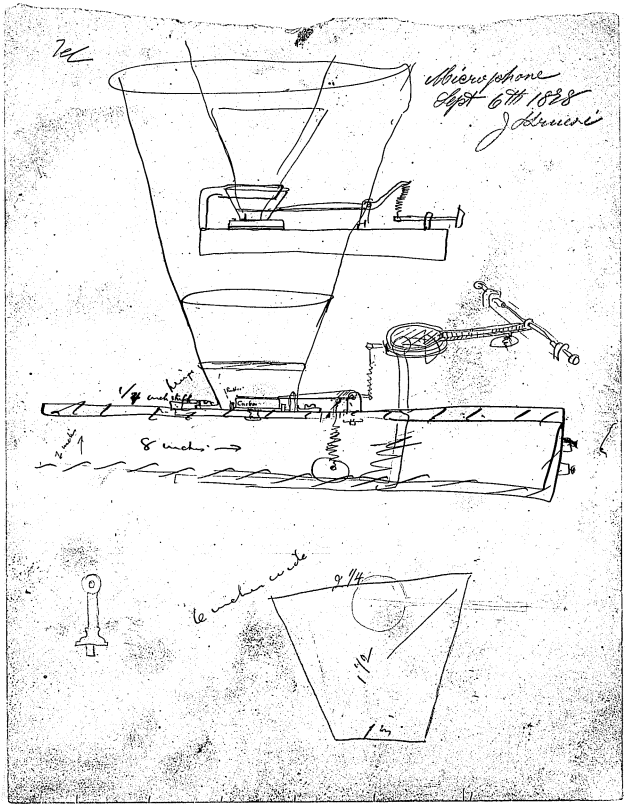
FROM THE LABORATORY OF
T. A. EDISON.
MENLO PARK, N. J.
U. S. A.

Edison's Megaphone
July 27th 1878
Menlo Park N.J.
Chas Batchelor
J. Krusi

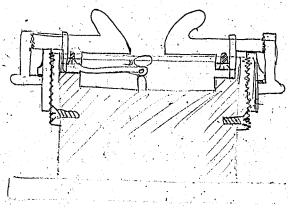



Chaysatchelos


A
b

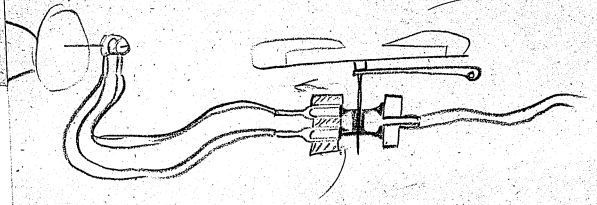

Microphone
Sept 6th 1878
J Hughes
8 inches
9 1/4
1 1/2

Aerophone Sept 27 1
Alexander

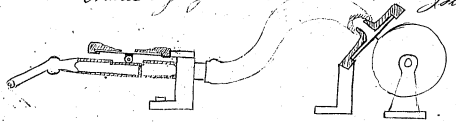


J A Edison

Aerophone Sept 27 1878
Alexander Graham Bell



Made by John F. Ott Nov 30th 1878 Johnsville



T. A. EDISON,

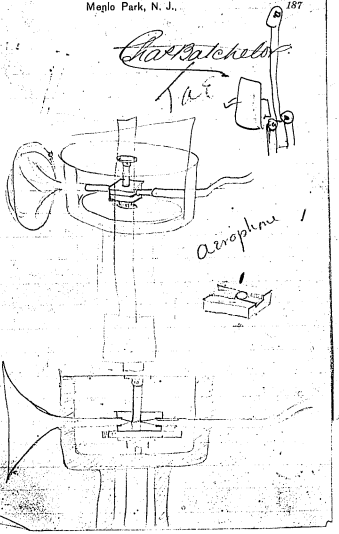
Menlo Park, N. J.,

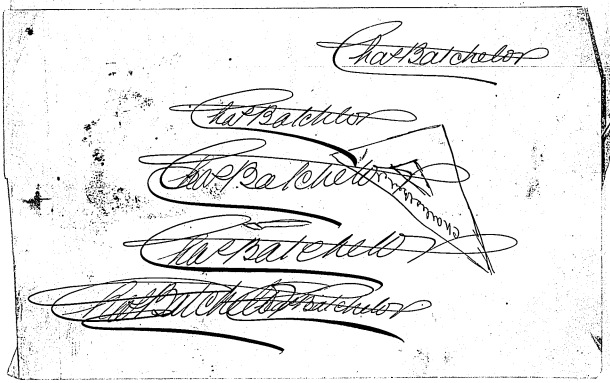
187

Chas Batchelor

Del

Aeroplane




Chas Batchelor
Chas Batchelor
Chas Batchelor
Chas Batchelor
Chas Batchelor

1878. Carbon Rheostat (NS-78-003)

Numbered pages 1-16 precede all other notes and drawings. These pages were copied by William Carman into Experimental Researches, Vol. 4, pages 270-283.

Carbon Resistance

Aug. 15 1 1878

Personally appeared before me this day of
19 , the said Thos. A. Edison,
Chas. Batchelor, John Kruesi, and Martin Force,
and acknowledged the above to be their signature

Chas Batchelor

Notary Public.

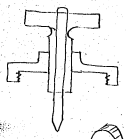
J Kruesi

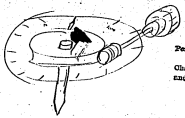
T A Edison

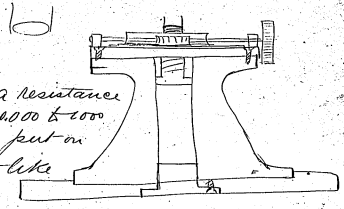
Martin Force

Personally appeared before me this
19 , the said Thos. A. Edison,
Chas. Batchelor, John Kruesi, and Martin Force,
and acknowledged the above to be their signature

Notary Public.







In order to make a resistance box to go from 10,000 to 1000 it is necessary to put on dial arrangement like sample

Carbon Rheostat Aug. 16th 1878

J. Krusi

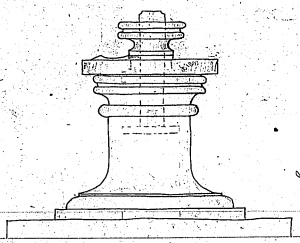
T. A. Edison

Chas. Batchelor

Martin N. Force

Personally appeared before me this day of 19 the said Thos. A. Edison, Chas. Batchelor, John Krusi, and Martin Force, and acknowledged the above to be their signature

Notary Public.



Copyrighted Aug. 27th 1878 by the Author

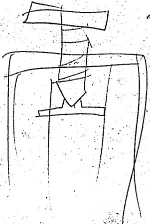
Carbon Rheostat

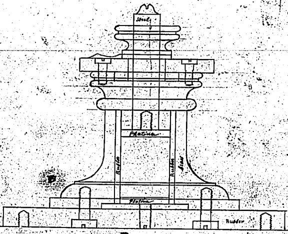
Carbon Rheostat Aug: 16th 1878. 3

J. Kruesi
Chas Batchelor
T A Edison
Martin Force

Personally appeared before me this day of
18 , the said Thos. A. Edison,
Chas. Batchelor, John Kruesi, and Martin Force,
and acknowledged the above to be their signature

Notary Public.





Copied on page 271 Vol 4 Ext Researchs
Dec 16. 1878

Personally appeared before me this day of 18 , the said Thos. A. Edison, Chas. Batchelor, John Krouse, and Martin Force, and acknowledged the above to be their signature

Notary Public.

T A Edison

Fractional Rheostat

Aug 26 1878

Shunt for Fractional Balancing Multiple Galvanometer

Thos. A. Edison
Chas. Batchelor
Martin Force

Copied from Page 272 Vol 4 Book Records Dec 16, 1878 Pat Comm

20 of these, Gutton

Personally appeared before me this day of 18 , the said Thos. A. Edison, Chas. Batchelor, John Krouse, and Martin Force, and acknowledged the above to be their signature

Notary Public.

Shunt

Shunt

Shunt

Battery Battery Battery Battery Battery Shunt

Battery Battery

Aug. 27th 1878

J Kruesi 5

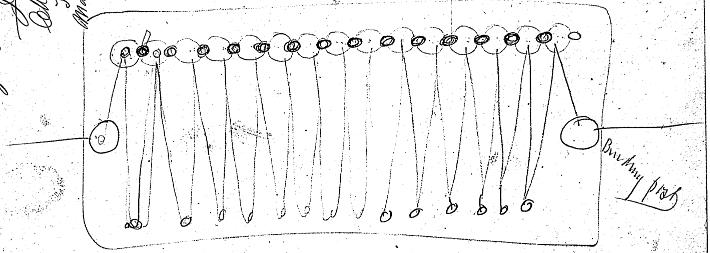
Chas Batchelor

T A Edison

Martin Force

Personally appeared before me this day of
18 , the said Thos. A. Edison,
Chas. Batchelor, John Kruesi, and Martin Force,
and acknowledged the above to be their signatures

Notary Public



Fractional Rheostat

15

Copied on Page 273 Vol 4 Elec Researches
Apr 16. 1879
WCarman

T. A. EDISON.

Aug 31, 1881

Carbon Rheostat

Menlo Park, N. J., 187

Edward Johnson

J. Kruesi

Witness my hand this 31st day of August 1881

Witness

Personally appeared before me this 31st day of August 1881 the said Thos. A. Edison, Chas. Batchelor, John Kruesi and Edward Johnson and acknowledged the above to be their deed.

Notary Public.

Edisons Carbon Resistance. Sept 4th 1879

Chas Batchelor
Jas Ross
Martin Force
Callaus

135 Unmagged lines. Test from Port Callaus

These tests taken on 1 coil Callaus on 1 pot.

135 Discs Deflec. 9 1340 ohms

135 — Deflec. 40 120 ohms } Screw moved down 20.

J Ehrets

Personally appeared before me this day of 19 the said Ches. A. Edison, Chas. Batchelor, John Ehrets, and Martin Force and acknowledged the above to be their signature

Notary Public.

1/2 { 67 Discs. Deflec. 3 — 3760 ohms
Deflec. 46 — 60 ohms

3/4 { 101 Discs Deflec 3 3760
Deflec 42. 90 ohms

1/4 { 34 Discs Deflec 3 3760 ohms.
Deflec 30 ohms.

34 Discs Same with 3 c 4960 ohms
37 ohms.

Quad Carbon Resistance

9020
820

Resistance of Carbon Button Nov 21, 1879 Sept 4, 1879 Mr Crocker

The one cell tests are probably unreliable owing to slight deflection

67 Discs Deflection 7. 5600 ohms 420
Deflec 60 6706 ohms 9890

101 Discs. Deflt 67. 107 ohms 5600 4950 650

5 1/2 6706

5600
6706
1806
1106

Edison Carbon Disc Resistance

Feb 14 1878

Wants it to test 14 with pressure

Discs used last night No 3 coil Bell Callan

Deflect 1½ with pressure 34 Martin Force

Make solution that will give ½ this

and try it

Water 4 oz
Dextrine 1 oz
Plumbago ½ oz.

This test [redacted] × 46

Sworn to before me this 7th day of February 1878
Chas. Batchelor

Dec 31, 1877

Personally appeared before me this 31 day of December 1877 Chas. A. Batchelor, John Kruesi, Chas. Batchelor, and Martin Force the subscribers to the above certificate and acknowledged the above to be their signatures

Notary Pub

46
22

Water 4 oz
Dextrine 1½
Plumbago ½ oz

This tests 1½ — 22

Water 4 oz
Dextrine 1 lb 15 dwt
Plumbago ½ oz

This tests 22 — this was rubbed off a little more than the last

Water 4 oz
Dextrine 2 oz
Plumbago ½ oz

This tests 18

Edisons Carbon Liquid Resistance Sept 6 1878 9

Chas Batchelor
J Kruesi
Martin Force
T A Edison

old

1 — 23
2 — 57
3 — 33
4 — 17 +
5 — 17 +
6 — 24
7 — 54
8 — 58
9 — 24
10 — 28
11 — 18 +
12 — 28
13 — 28
14 — 30
15 — 28
16 — 28
17 — 28
18 — 18
19 — 20
20 — 20

20 | 581
29 average ohms

new

~~ocl~~ Scraped

1 — 220 — 80 } 260
— 140
2 — 97
3 — 32 64 +
4 — 33 — 206 +
5 —
6 —
7 —
8 —
9 —
10 —
11 —
12 —
13 —
14 —
15 —
16 —
17 —
18 —
19 —
20 —

Personally appeared before me this day of 13, the said Thos. A. Edison, Chas. Batchelor, John Kruesi, and Martin Force, and acknowledged the above to be their signature

Notary Public

Copied on P 276 Vol 4 Dec 21, 1878 W Carman

Voltameter Sept 6 78

10 1/2 16

25 16 1/2 16 1/2 16 1/2 16 3/4 16 1/4 17 1/2 18 1/4 19 18 1/4 18 1/4 19 18 1/2 18 1/2 19 1/2 19 19 20 19 3/4 19 3/4 20 19 3/4 20 19 3/4 19 3/4 19 3/4 21 20 1/4 20 20 1/2 20 19 3/4 20 1/2 19 18 3/4

Fractional Phonetic Type 11 Nov 1878

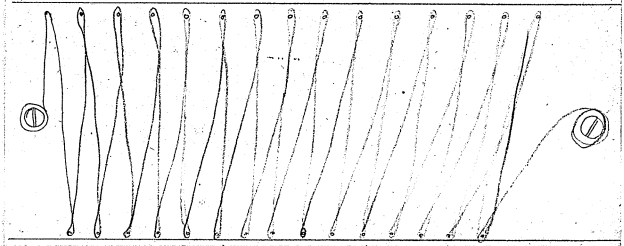
J. Struckel
Chas Batchelor
J A Edison
Martin Force

Personally appeared before me this day of 18 , the said Chas. A. Edison, Chas. Batchelor, John Ernest, and Martin Force, and acknowledged the above to be their signatures

Notary Public.

Personally appeared before me this day of 18 , the said Chas. A. Edison, Chas. Batchelor, John Ernest, and Martin Force, and acknowledged the above to be their signatures

Notary Public.



Copied on page 777 Vol 4 Ext Research Rec 21, 1878 MC Cumm

Carbon Resistance for Sept 12 1878

Quadruplex Martin Force Johnson J.H. Edison

Chas Batchelor

Geo E Barnaby

3 cells Carbon Battery 1 Small Cell Rest of Cells

10 Elements Series 25/8 inches

	9	4160	Series lamps 1/8 ohm
	11 1/2	2,160	
75	4	9.170	" " 1/8 "
	15	2.500	
50	22	1.600	1/8 ohms Imperial to fill it up
	48	450	
25	29	1153	2 1/2 lamps 1/8 ohm
	50	373	3 1/2 lamps 1/8 ohm

75 5 1/2 1730

rep. 25 4170

Steam for Dynamo

Sept 13. 1878

22 = 16.40

Copies on P. 278 Vol 4 Ed Record over 21. 1878

Personally appeared before me this 13th day of Sept 1878 the said Chas. A. Tinker, John Kensel, and Martin Force, and acknowledged the above to be their signatures

Notary Public

Carbon Resistance for Quad Sept 13 1904

Personally appeared before me this day of
19 the said Chas. A. Edison
Chas. Batchelor, John Krusi, and Martin Force
and acknowledged the above to be their signature

Notary Public.

Chas A Batchelor

20 Cells Calland
75 discs of 2½ Plumbago made from Standard

Johnson
Morrison
10 AM Sept 13.

75 discs with pressure 75 deg. 1440 ohms
without pressure 62 deg 2840 ohms

tested on 3 coil
75 discs with pressure 8 2/4 — 1440
4 3/4 — 2840

3 cells Calland on 1 coil again
75 discs with pressure 24½ 1540
without pressure 14 2870

Personally appeared before me this day of
One Batchelor, John Krusi and Martin Force
and acknowledged the above to be their signature

Notary Public

Leaked out Page 419 Oct 21, 1904 MMorrison

5 hours after
Take test at 2 p.m.

3 pm Sept 14

Mr Cut 3 cells calland	25 =	1540 ohms	24 hours after	
	75½ =	2690	24½ =	1440
			15½ =	2690
1 coil 20 cells Calland	75	1440	74½	1400
	62	2720	63	2690
20 cells 3 coil	49	1400		1400
	75	2670		2670

Carbon Rheostat for Quadruplex

Sept 14th 1875 13

Chas Batchelor

J A Edison

Witness Force

Personally appeared before me this 13 day of Sept 1875 the said Chas. A. Batchelor, John Kruesi, and Louis Force and acknowledged the above to be their signatures

Notary Public

Clothed on Page 280 Vol of Book Records of Pat Office

Rack works by Cams. so that each one goes it full distance before another commences and the last one starts back first

Carbon Rheostat for Quadruplex

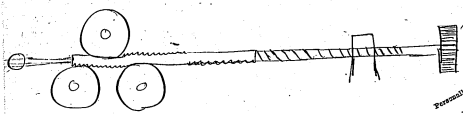
Sept 14 1878

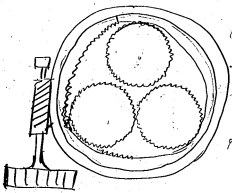
Chas Batchelor

J A Edison
Menlo Park
Martin Force
Acct

Personally appeared before me this 19 day of Sept 1878 Chas. A. Francis and acknowledged the above to be his signature

Notary Public.





3 Cogs with pressure rollers working inside an annular wheel provided with ⅓ cog. Wheel takes each wheel by itself & returns the same way.

Copied on Bk 3-8 Vol 4 Ends Rec'd Oct 24/78

W. H. Carman

Electron Resistance for Sept 16th 1898
Quadruplex

After taking out the 75 ohm coils pressing
Vertical Rheostat

	with Battery	without
3 Cells Call 1 Coil	39½ 790	17 2390
2 Cells Call 1 Coil	82½ 720 ohms	6½ 2390
2 Cells Call 3 Coil	15½ 720	5 2390

Dept 1898

100 Discs Each pressure empty and then

		with Battery		without Battery	
3 Cells Call 1 Coil		35	823	17	8070
duty Sept 21st		35½	823	15½	4070
" " "		75½	770	49	3900
" " 22		75½	740	60	2420
" " 23		38	760	14½	2690
" " "		~~14~~	~~2690~~		
" " "		37½	803	10¾	4080
" " 25		37½	803	10½	4080
" " 26		30	1145	6	6630
" " "		30	1145	7	6100
125 Discs " " 27		31	1100	11½	37

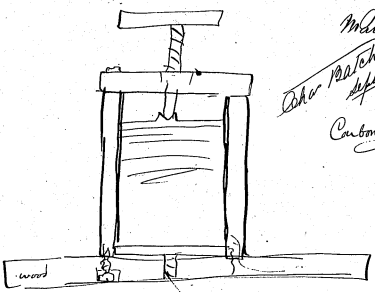
Collins Comp. Pressure Test 6 R

Speaking Telephone — Improvement with magnet & diaphragm — No. 186

T. A. Edison
J. Ismay
Martin Force

Exhr. 12 Schedule of 1878

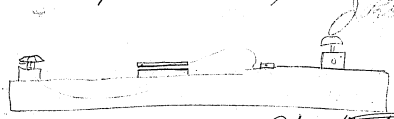
Carbon Rheostat



Copies on Page 24 & 25 of Exp. Record Oct 22 1878
M Connor

Personally appeared before me this 4th day of Nov. 1878, A. D. 1878
Chas. Batchelor, John Ismay, and Martin Force, and acknowledged the above to be their signatures
Notary Public.

Apparatus for Testing the Resistance of Rubber Sept 19th 1878



Chas Satchelor

* weight one gramme

Carbon Resistance for Quadruplex

Sep 29

Sep 29 to 1878

SAE

Chas Batchelor

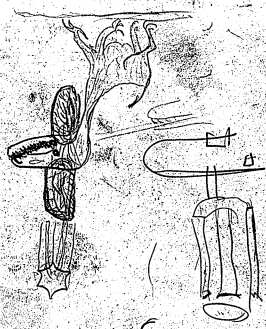
E E Johnson

M. Tate

123 Discs Each pressed simply and then together

3 cubic Calc. 1 cinc

	Metal	Pressure	With Pressure
after standing Packed 22 hours	30	11 20	13 — 8120
Sep 30. 9 am	30	11 20	10 — 2930
" 430 PM	31	10 60	11½ — 3490
"	30½	10 90	11 — 3610
"	30	11 20	10½ — 3770
"	30	11 20	10½ — 3770
Standing Pressed down Untill Oct 2.	31	10 10	13 — 2880
" 7 to 830	30	10 30	14 — 2920
" 11 1130	30	10 00	9½ — 3390



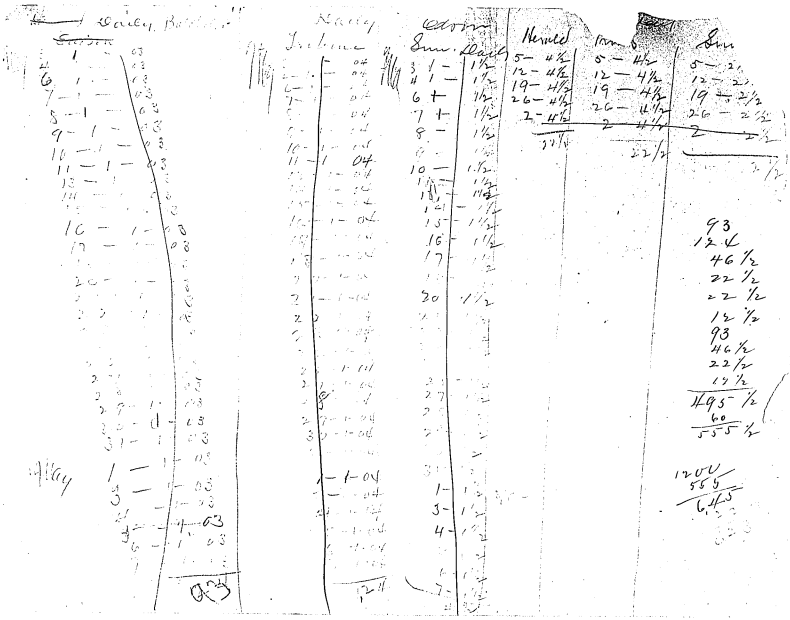
1878. Chemophone (NS-78-004)

Chemistry

June 21st 1878
J. Johnson

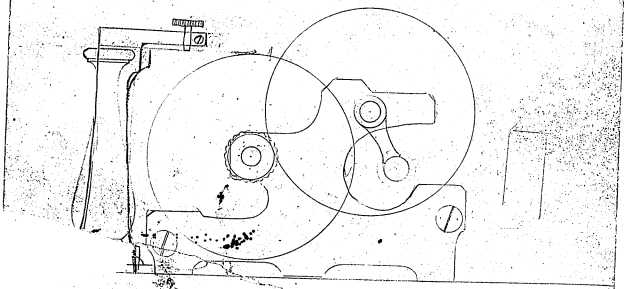
Copper x
Zinc ✓
Lead ✓
Tin ✓
Platinum ✓
Iron ✓
Steel ✓
Nickel

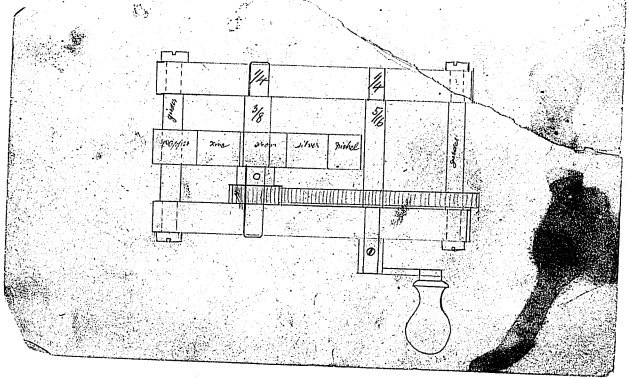
3 steam

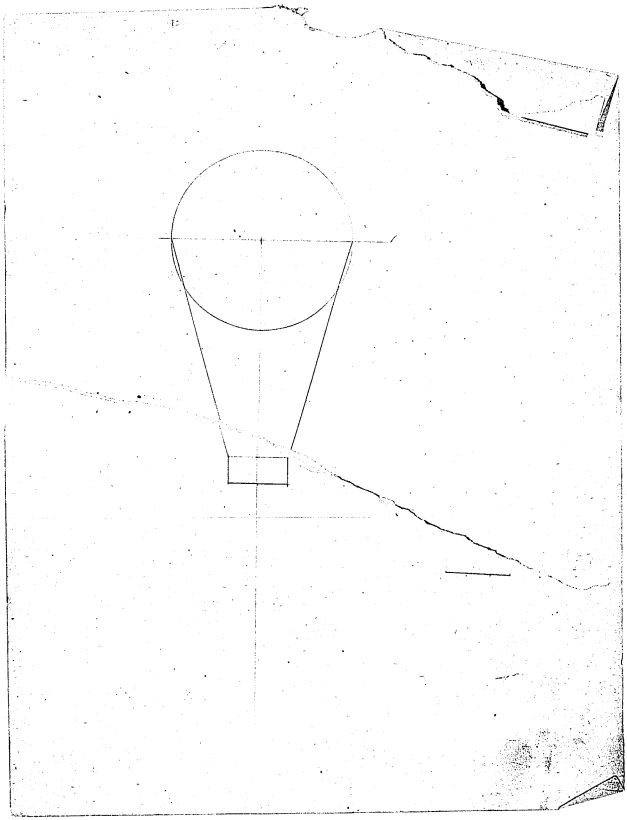


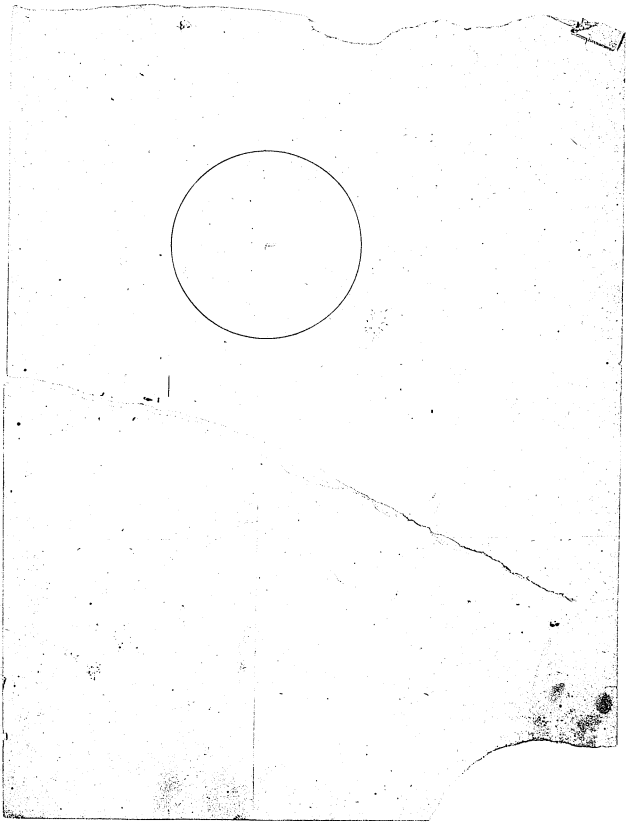
Chemophone June 21st 1878

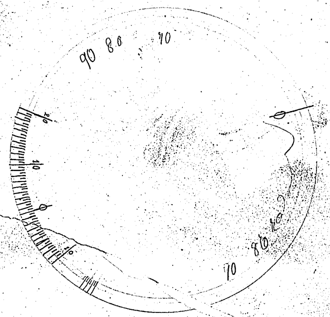
Chas. D. Batchelor










90 80 70
20
10
0
10
0
70 80 90

1878. Electric Light (NS-78-005)

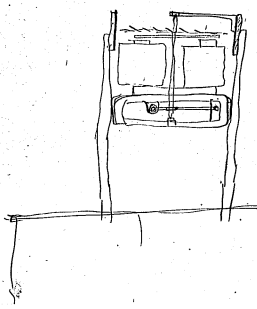
Numbered pages 1-6, relating to electric engines, precede all other notes and drawings. These pages were copied into Experimental Researches, Vol. 6, pages 1-4. This folder also contains draft sketches for electric light caveats, some of which were copied into Experimental Researches, Vol. 5, pages 69-86.

Original Drawings

Electric Engine

For Lamp. Sept 1878

Wm Carman



T. A. Edison

Chas. Batchelor
Sept. 20 1887
Johnson
Force
Martin

Personally appeared before me
Chas. Batchelor, John Kruesi, and Samuel Insull
and acknowledged the above to be their signatures

Notary Public

Electric Gas for Steam

Continued on Page 1 Vol 6 Exp. Records

(2)

(2)

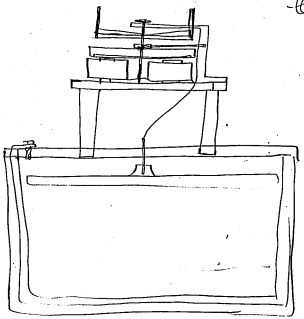
Electric Lamps Sept. 8th 1828

2

Chas Satchelor

Ja Edson

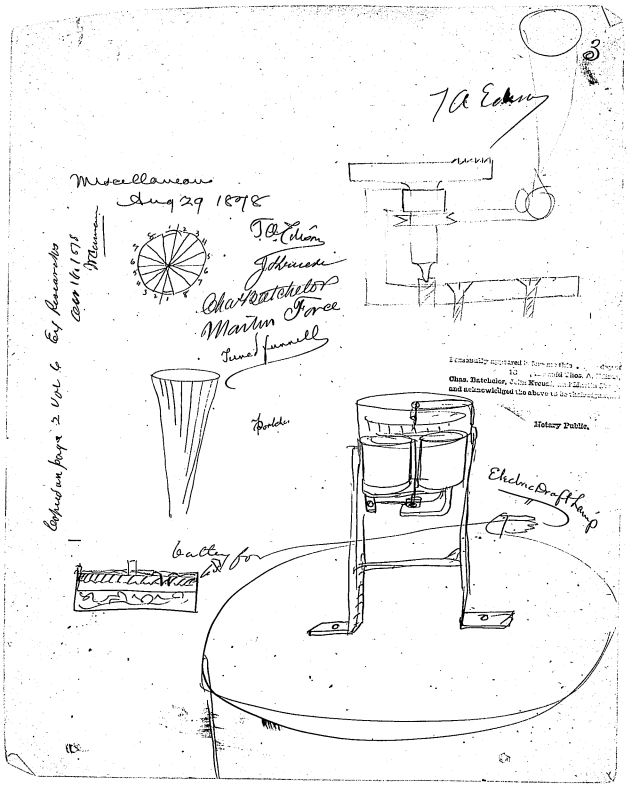
Martin Force



Personally appeared before me [illegible]
Chas Satchelor, [illegible]
and acknowledged the same to be [illegible]

Notary Public.

Received on Page 1 of 6 Ext Records
Oct 15. 1878


Miscellaneous
Aug 29 1878
T A Edison
J Kruesi
Chas Batchelor
Martin Force
Jno Kruesi
Copied on page 2 Vol 6 Ex Records
Chas. Batchelor,
Notary Public.
Ehelmo Draft Lamp
battery for

Electric Engine for Lamp

Sept 9th 1878

Chas Batchelor

T. A. Edison

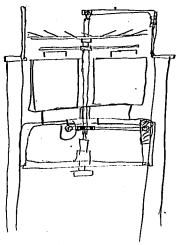
J. Krusi

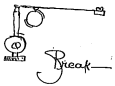
Martin Force

Personally appeared before me this day of 18 , the above named Chas. Batchelor, T. A. Edison, and and acknowledged the above to be their signatures.

Notary Public.

Copies on page 3-Vol. 6 Expt Record and Cert 16.1878





Royalty

Royalty

Electric Engine for Camp Apr 21st 1878 5

T A Edison

Chas Batchelor

J Kruesi

Martin Force

Mr Kruesi —

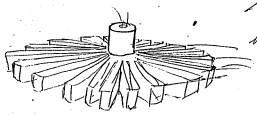
Will you please make a

Line for this battery that has all side

surface something like this with no

bottom surface Hardly

but all side surface



Batchelor

Personally appeared before me this day of

19

Chas. Batchelor, [illegible] and

and acknowledged that he executed the

Notary Public.

X = internal resistance

X + 1.46 ohm = 43.30 degree

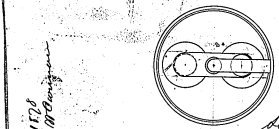
X + 1.46 ohm + 1 ohm = 37.20

.2058 ohm

Copied on page 3 Vol 6 Exp Records

Oct 16, '96

Mm Boarman



Dept of Elect

Electric draft lamp.

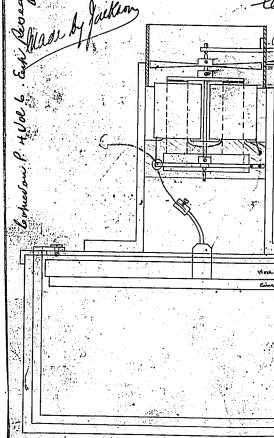
Chas Batchelor
J Krusi
T A Edison
Martin Force

Witness: Jas. A. Fullon
Chas. Batchelor

Witness: Jas. A. Fullon
Chas. Batchelor, John Krusi, and Martin Force

Personally appeared before me this day of 18 , the said Chas. A. Fullon, and acknowledged the above

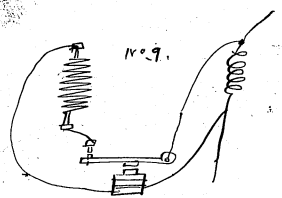
Notary Public.

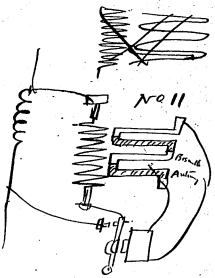


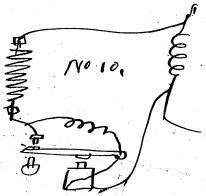
Sept 8. 1878.

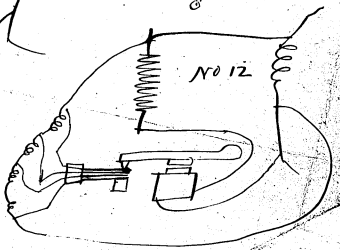
Electric lamp

J. A. Wilson









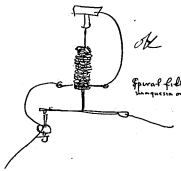
T. A. EDISON.

Sept 27 1878

Menlo Park, N. J., T A Edison 187

add, Electric Light Current.

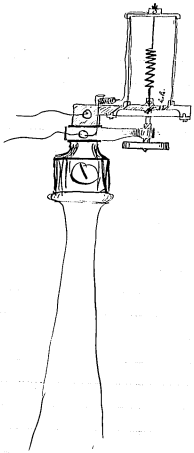
No. 3.



T. A. EDISON.

Career No 3

Menlo Park, N. J., Oct 1 187



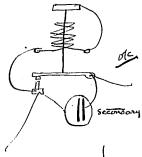
T. A. EDISON.

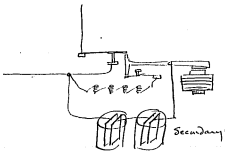
Electric Light

Caveat No 3.

Menlo Park, N. J., Oct 1 1878

T. A. Edison



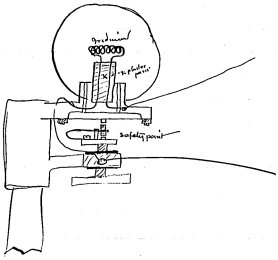


T. A. EDISON.

Caveat No 3.

Menlo Park, N. J., Oct 1 1878

T. A. Edison



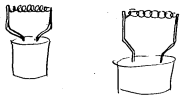
T. A. EDISON.

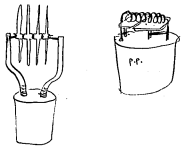
3rd Caveat

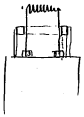
Menlo Park, N. J., Oct 1 1878

T A Edison

Spirals.





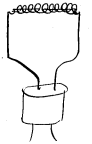


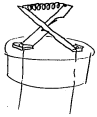
T. A. EDISON.

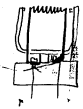
3rd Caveat

Menlo Park, N. J., Oct 1 1878

T A Edison

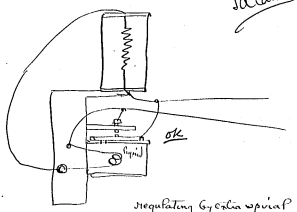






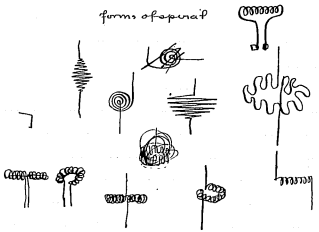
T. A. EDISON.

Menlo Park, N. J., Oct 1 1878



Regulating Cylinder spiral in arc or Polyzoid.

forms of spiral



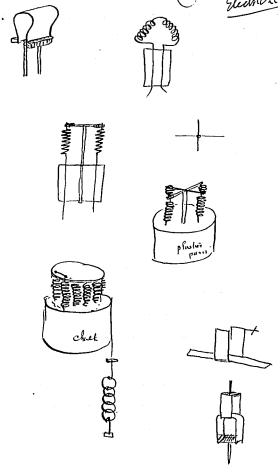
T. A. EDISON.

Oct 1, 78

Menlo Park, N. J., 187

forms of spirals

Electric Light

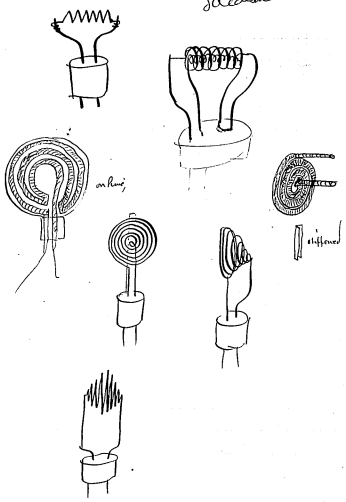


T. A. EDISON.

Caveat No 3 Medium Oct 1

Menlo Park, N. J., Oct 1 188[illegible]

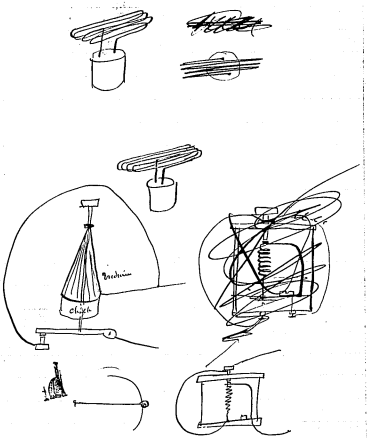
J.A. Edison



T. A. EDISON.

Caveat No 3 1878 Oct 3 1878 Edison

Menlo Park, N. J., 187

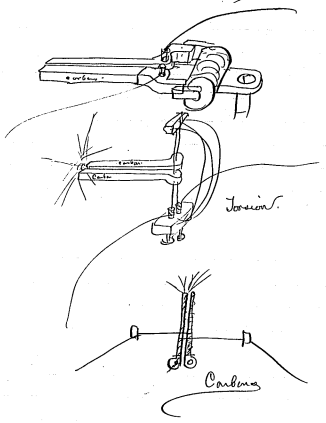


T. A. EDISON.

Caveat 4. Electric Light

Menlo Park, N. J., Oct 3rd 1878

Chas Batchelor



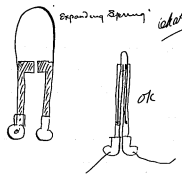
T. A. EDISON.

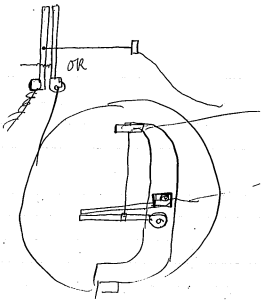
Electric Light Carbon Tel

Menlo Park, N. J., Oct 3 1878

Chas Batchelor

Caveat 4





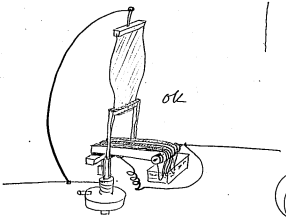
T. A. EDISON.

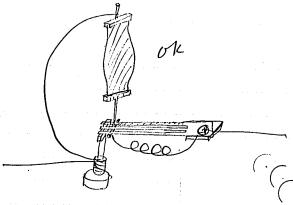
Caveat 4

Jae. Electric Light

Menlo Park, N. J., Oct 3 1878

Characteristics



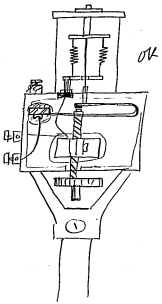


T. A. EDISON.

Caveat No 4 No 1

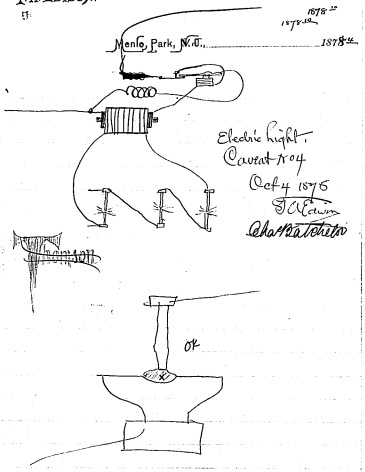
Menlo Park, N. J., Oct 3rd 1878

Characteristics



T. A. EDISON.

Menlo Park, N. J., 1878

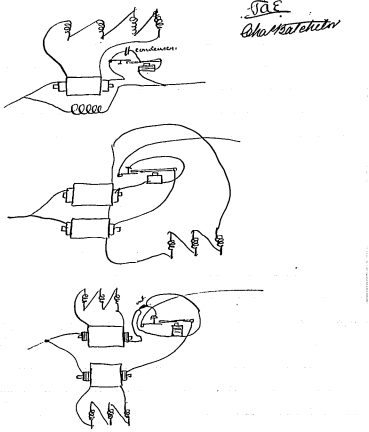


T. A. EDISON.

Electric light
Caveat No 4

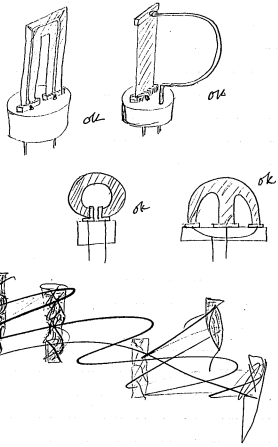
Menlo Park, N. J., Oct 4 1878

TAE
Chas Batchelor



T. A. EDISON.

Caveat 4 Menlo Park, N. J., Oct 4 1878
Electric Light

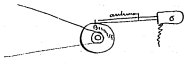


T. A. EDISON.

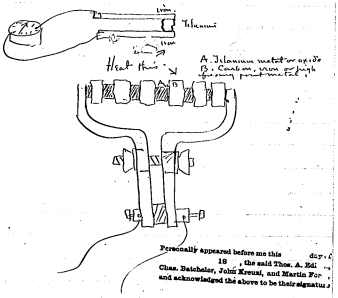
Menlo Park, N. J., Oct 4 1878

Miscellaneous

Thermo-pile worked by steam power



Motored by power



Personally appeared before me this day of
19 , the said Thos. A. Edi
Chas. Batchelor, John Krusi, and Martin Fo
and acknowledged the above to be their signatu

Notary Public.

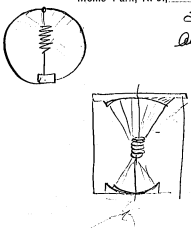
T. A. EDISON.

Convt No 4 Electric Light

Menlo Park, N. J., Oct 5 1878

JAE

Characteristics



I propose to use reflectors on the bottom and top of the straight glass holders, or in the case of a globe place the incandescent conductor in the centre so it will be in the universal focus. Perhaps I can use something on the glass that will radiate well, thus throwing back the heat & allowing the light to pass through,

JAE

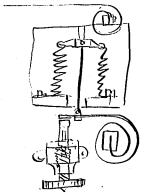
If Iridium even is so impure, I propose to use a cable composed of a number of excessively fine wires twisted together instead of a single strand with the same amount of metal in the strand & cable

T. A. EDISON.

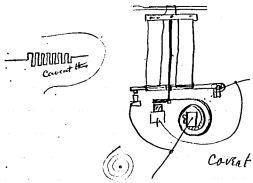
Electric Light No 4

Menlo Park, N. J., October 5 1878

Characteristics



Conv.



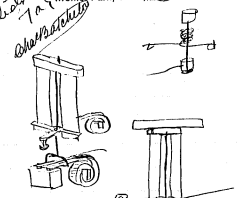
Convt No 4

Convt.

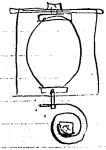
T. A. EDISON.

Menlo Park, N. J., Oct 5 1875

Electric Light for C. Shortsketch



Use flattened Spirals



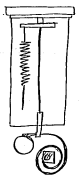
1 ohm	1/2
2	4
4	8
8	16
16	32
32	64
64	128
128	256
256	512

T. A. EDISON.

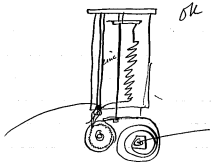
Menlo Park, N. J., Oct 6th 1875

Caveat 104

Electric Light T.A. Edison Manhattan Elec. Lt. Co.



OK



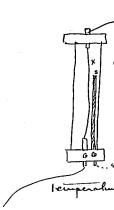
T. A. EDISON.

Caveat No 4.

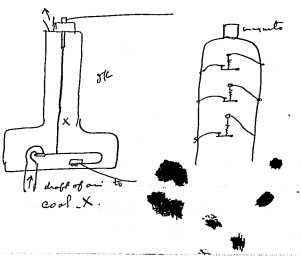
Menio Park, N. J., Oct 8 1878

J.A.P.

Chas Batchelor



Platinum wire X heated to incandescence by current flows exclusively forward & a valve at when it reaches a certain temperature thus cooling it.



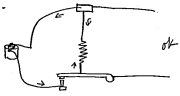
T. A. EDISON.

Caveat No 4

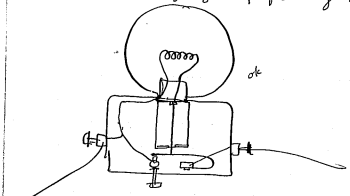
Menio Park, N. J., Oct 8 1878

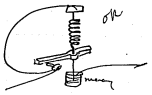
J.A.Pearson

Chas Batchelor



Paint the globes with substance that will reduce the reflexibility of the light.





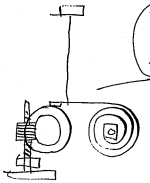
T. A. EDISON.

Patent No 14

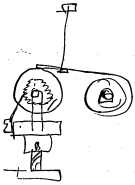
Menlo Park, N. J., Oct 4 1878

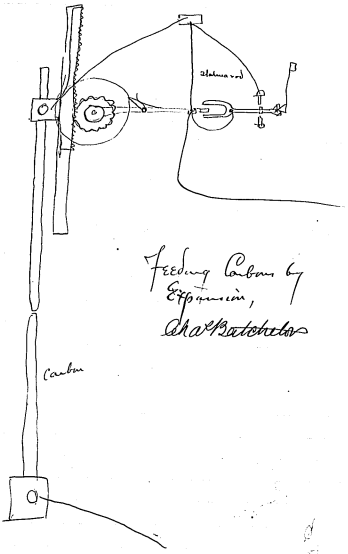
W. Edison
Chas Batchelor

Martin Force



Thompson
Thompson





Concept No. 5
Jan
Oct 12 1898

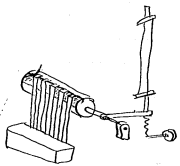
Feeding Carbon by Expansion,
Chas A Batchelor

T. A. EDISON.

Menlo Park, N. J., Oct 15 1878

Electric Light

Caveat No 5



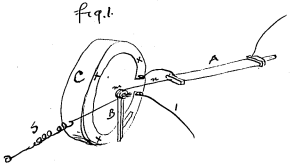
T. A. EDISON.

Electric Light

Menlo Park, N. J., Oct 15 1878

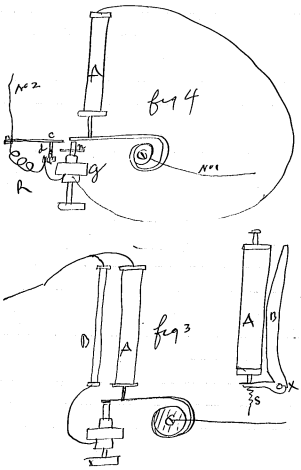
Caveat No 5

Fig. 1.



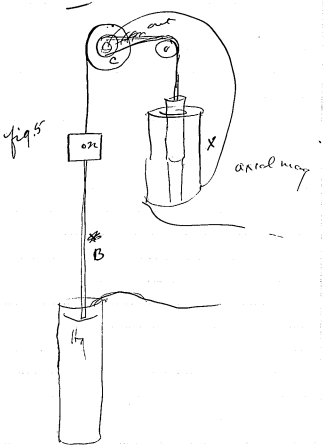
T. A. EDISON.

Electric Light
Menlo Park, N. J., Oct 13 1878
Caveat No 5 T.A. Edison



T. A. EDISON.

Menlo Park, N. J., Oct 15 1878
Caveat No 5 T.A. Edison



T. A. EDISON.

Caveat 105 — Electric Light 10 —

Menlo Park, N. J., Oct 15 — 1878

T A Edison
Chas Batchelor

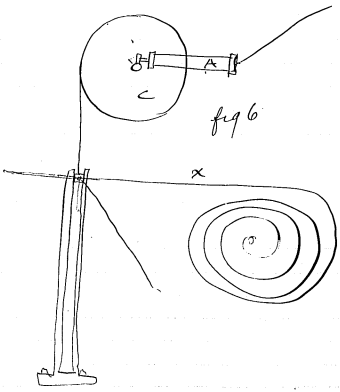


fig 6

T. A. EDISON.

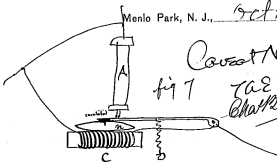
Electric Light 10

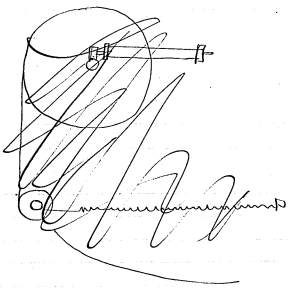
Menlo Park, N. J., Oct 15 1878

Caveat 105 —

fig 7

T A E
Chas Batchelor





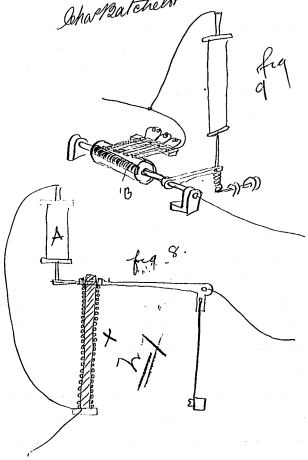
T. A. EDISON.

Electric Light

Menlo Park, N. J., Oct 13 1876

Caveat No 5.

Chas Batchelor

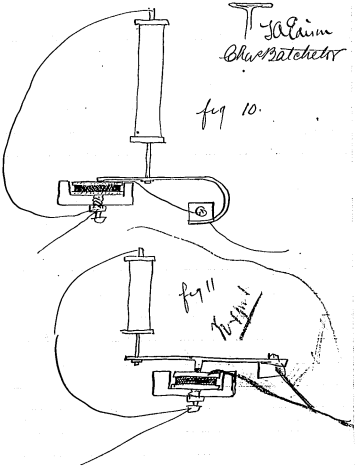


T. A. EDISON.

Electric Light

Menlo Park, N. J., Oct 15 1876

Chas Batchelor

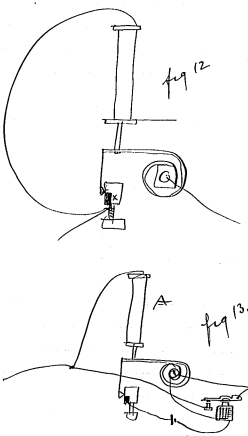


T. A. EDISON.

Menlo Park, N. J., Oct 15 1878

Electric Light Caveat 105, T A Edison

Chas Batchelor



T. A. EDISON.

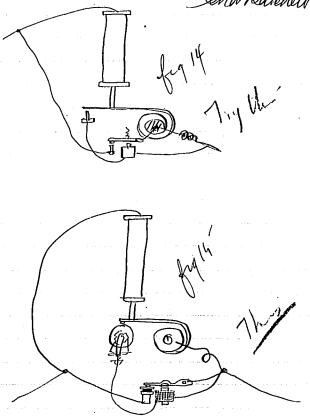
Caveat 105

Menlo Park, N. J., Oct 15 1878

Electric Light

T A Edison

Chas Batchelor



T. A. EDISON.

Electric Light

Menlo Park, N. J., Oct 15 1878

Caveat 105

TA Edison

Chas Batchelor

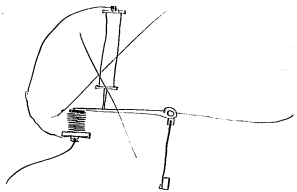
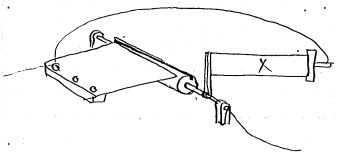


fig 16.

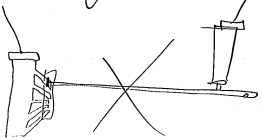


T. A. EDISON.

Caveat 105

Menlo Park, N. J., 187

Electric Light



Caveat No 5

TAE

Chas Batchelor

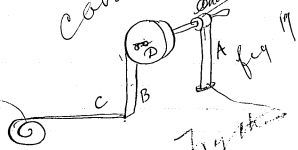
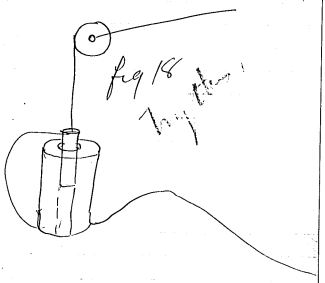


fig 17

T. A. EDISON.

Menlo Park, N. J., Oct 14 1878

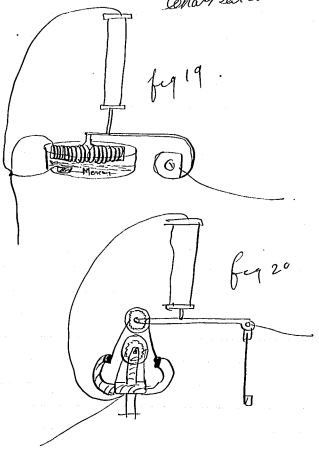
Caveat No 5 Chas Batchelor



T. A. EDISON.

Menlo Park, N. J., Oct 14 1878

Caveat No 5 Chas Batchelor



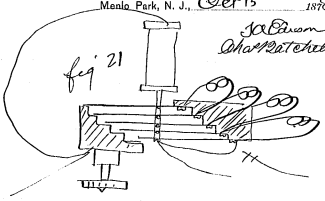
T. A. EDISON.

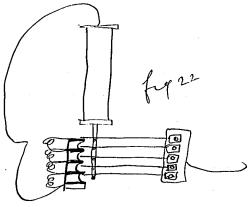
Caveat No 5 — Electric Light

Menlo Park, N. J., Oct 15 1878

J. A. Edison

Chas Batchelor





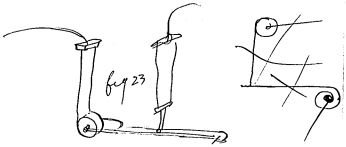
T. A. EDISON.

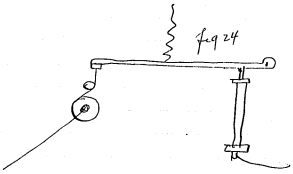
J. A. Edison Electric Light.

Menlo Park, N. J., Sept 15 1878

Caveat No 5 —

Chas Batchelor





T. A. EDISON.

Caveat No 4 — T.A.E

Menlo Park, N. J., Oct 15 — 1878

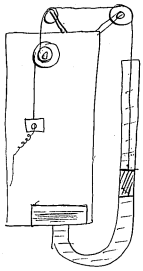


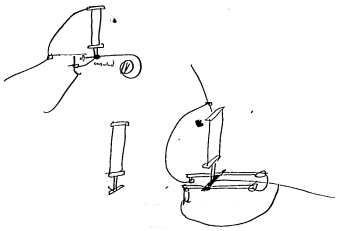
fig 24 —

T. A. EDISON.

T.A.E Electric Light —

Menlo Park, N. J., Oct. 6 1878

Caveat No 6

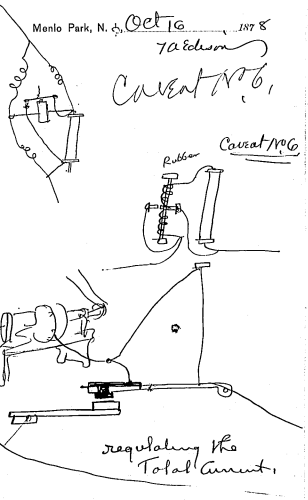


T. A. EDISON.

Menlo Park, N. J., Oct 16, 1878

T A Edison

Caveat No 6,

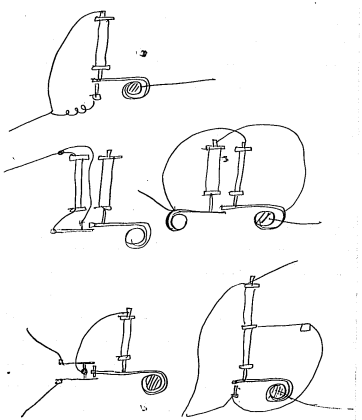


T. A. EDISON.

T A Edison

Menlo Park, N. J., Oct 16, 1878

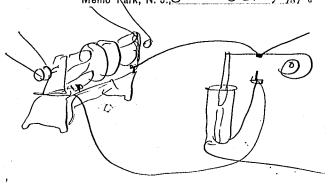
Caveat No 6,



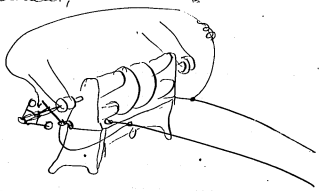
T. A. EDISON.

Caveat No. 6,

Menlo Park, N. J., TAE Oct 17 1878



Regulating the total Current,



Regulating the speed of the magneto also the Current,

Electric Light Oct 17. 1878

Thos. A Edison

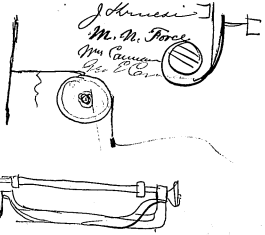
Chas Batchelor

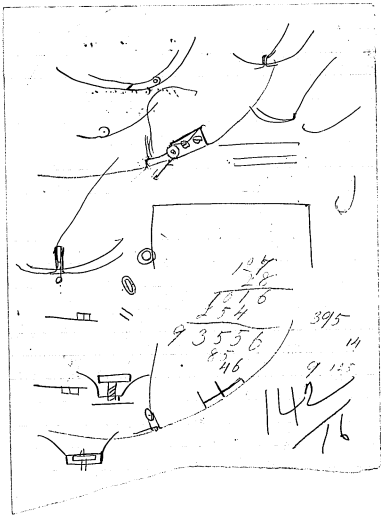
J Kruesi

M. N. Force

Mr Cowing

Asst Engr




395
142
16

T. A. EDISON,
Menlo Park, N. J.

Page 16–17
book dated Newark
July 25 1871

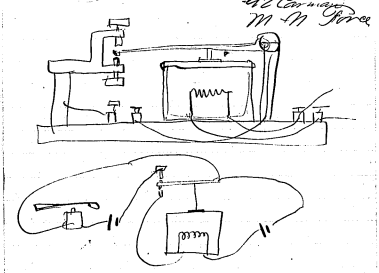
Maxim "Thermal" interference

T. A. EDISON.

Menlo Park, N. J., Oct 21. 1878 187

Thermal Relay —

Chas F Edison
Witness
J A Brown
A E Cornman
M M Powers



T. A. EDISON.

Menlo Park, N. J., Oct 23, 1878

Mr Kruesi

Arrange a piece of sheet platina as thin as can be rolled, in the glass bulb and fuse binding post with holes for largest wires on top and bottom it must be perfectly air tight same as at present

Chas Batchelor

T. A. EDISON.

Menlo Park, N. J., Oct 23 1878

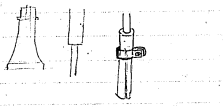
W. Edison

Mr Kruesi

Make another like this sketch but with a platina ¼ inch wide and same thickness as ¼ flat, and coiled up with edges butting so but not lapping this must test same as ¼ sheet

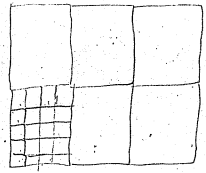
Batchelor

Johnson



Nov 2 1878

Calculation. 7a Edison



Jobelkoff 66 burners
Edison, 6 "
Jobelkoff 1/40 of burners
Edison 6/240 "

100

120, times the quantity.

17|1000,|66
90
100
90

66/1000

66÷15
330
66
99

Edison 8 cents 10 hours

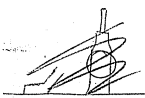
Jobelkoff 32 Cents 10 hours,

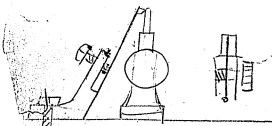
(18) Program: Edison, 24 burners, 32 cents 10 hours
" Jobelkoff 66 " 32 Cents 10 hours
Shows to Greater Quantity of Edison & number of
points getting round law of program, say: 35. Edison's
Equal. 1 Jobelkoff of 66 gas jets.

Make an Instrument as Nov 9 11/18

Chris Batchelor

a stand for a piece of carbon
1/16 thick and 5 springs
round it all connected
~~to~~ to a tin post of
its own the carbon to
a tin post also





Batchelor

Chris

M. A. Force

Thomas A. Edisons
Menlo Park N.J.

Nov 15-78

Electric Light

Copied [illegible]
Nov 15 [illegible]

Elect Light

Nov 15 1878

Law-

With a given wire having 1 ohm resistance & certain length brought to a given degree temp. by given battery. It will when coiled in such a manner that but one quarter of its surface radiates its temperature will be increased 4 times or — ¼ battery will bring it to temperature of straight wire Or same battery ~~using four wires~~ using four wires will bring it to the same temp. as straight wire

Total resistance is 4 ohms

This was actually determined by trial

The amount of heat lost by a body is in proportion to the radiating surface of that body. If one square inch of platina be heated to 100 deg it will ~~lose th~~ fall to say Zero in one second whereas if it was at 200 deg it would require 2 Second

Hence in the Case of meandescent Conductors if the radiating surface be 12 inches and the temperature on each inch be 100 or 1200 for all. if it is so cooled or arranged that there is but 1/4 or 3 inches of radiating surface then the temperature on each inch will be 400. If reduced to 3/4 of an inch it will have on that 3/4 1600 deg tho' notwithstanding the original amount was but 12 because the radiation has been reduced

to 3/4 or 75 units ~~from~~ since the effect of the lessening of the radiation is to raise the temperature of each remaining unit not radiating to 125 deg =

If the radiating surface was reduced to 3/32 of an inch the temperature would reach 6400 deg fahr

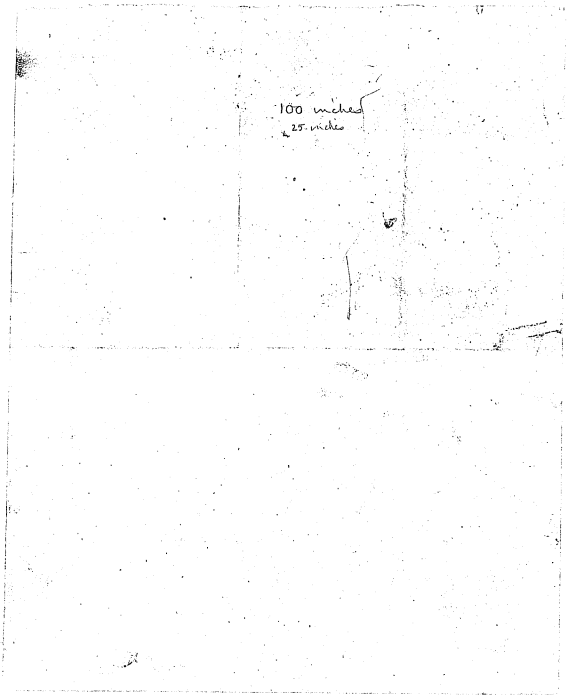
~~[illegible] of course~~ to carry out to the best advantage this law in regard to platina etc then with a given length of wire to quadruple the heat ~~and the~~ we must lessen the radiating surface to 1/4 + to do this in a spiral 3/4 must be within the spiral + 1/4 outside for radiating = hence a square wire or other means such as a spiral within a spiral must be used.

These results account for the enormous temperature of the

Electric arc with one horse power as for instance of 1 hp will heat a ~~1 foot~~ 12 inches of wire to 1000 deg fahr. if this concentrated to hand 1/4 of the radiating surface it would reach a temperature of 4000 deg or surface to melt it but supposing it infusible the further concentration to 1/8 its surface ~~or 1/4 of it~~ it would reach a temperature of 16000 & to $\frac{1}{32}$ its surface which would be about the radiating surface of the Electric arc it would reach 64000 deg fahr. of course when light it radiated in great quantities ~~the~~ not quite these temperatures would be reached —

~~from this~~

Another curious law is that
~~with~~ if it will require a greater initial
battery to bring an iron wire of the same
size and resistance to a given temperature
than it will a platinum wire, in proportion
to their specific heats, and in the case
of Carbon if a piece of Carbon 3 inches
long 1/8 diameter with a resistance of 6
ohms, it will require ~~of an~~ a greater
battery power to bring it to a given
temperature than it would a cylinder
of thin platina foil of the same length
diameter & resistance because the
specific heat of Carbon is many times
greater, besides if I am not mistaken
the radiation of a roughened body
for heat is greater than a polished
one ~~and~~ like platina which may be
polished,

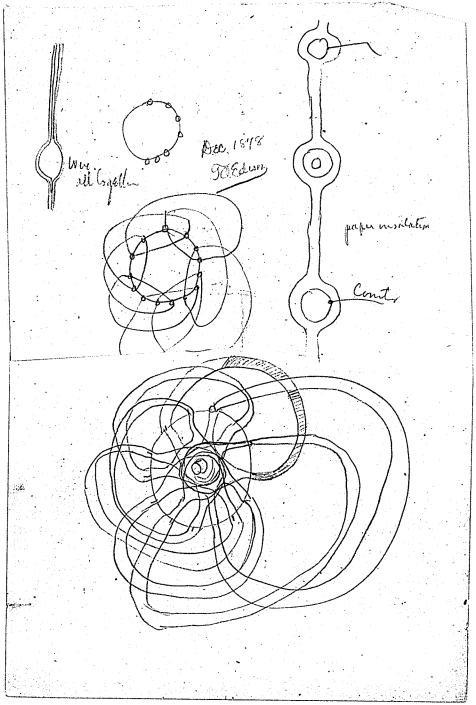

100 miles
25 miles

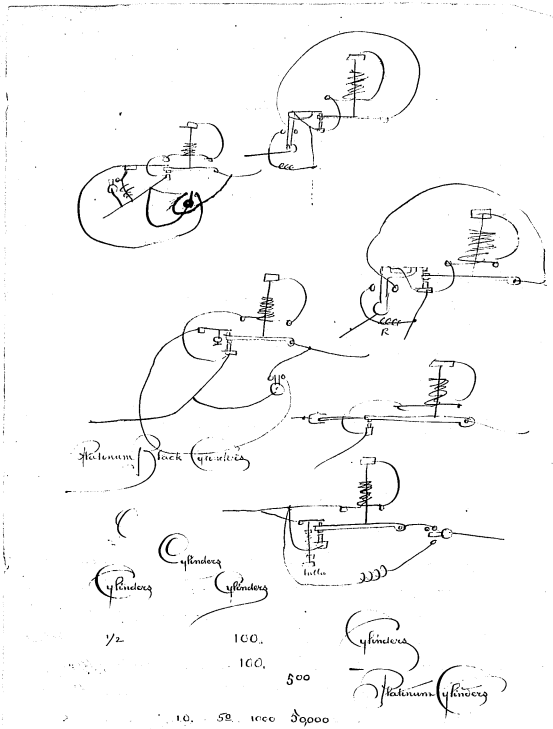
A gas jet equalling a Jobelkoff Candle when concentrated in the same space

a gas jet has — 10 square inches radiating surface as a gas jet. 15 candle p.
if reduced to 2½ " " 60
.62 " " 240
.015 " " 960

The latter radiating surface is about equal to the radiating surface of the arc, of a Jobelkoff Candle, hence an ordinary gas jet of concentrated to the size of the Jobelkoff are would give the same light, or in other words the same power which gives a gas jet of 15 Candle power would give 1000 by Concentration,

If the radiating power or time of combustion is decreased up the gain in light is directly to the decrease for instance if 9 coils with platina coils obtain 4 burners of 15 C.p. each per h power. then by reducing the power 50 per cent. 9 would obtain 8 burners —


Dec. 1648
papa moderatum
Comit


Platinum
Black
Cylinders
Cylinders
Cylinders
Cylinders
Platinum
Cylinders
1/2
100.
100.
500
10. 52. 1000 52000

Alison Godillot desires that during the time
asked for the justification of title, the patents
in question being submitted to the examination
of a special engineer who will note that the
formalities relative to these patents
have been complied with, of they are not
anticipated by others, and in case of there
is no obstacle to the
putting of them in exploitation in France
The parties have delayed this day the
convention of agreement need a letter of pouvoir
of consolidation only for to be regular.
as after the justification of the titles of powers
of Bailey & Perkins - the advice of the special
Engineer, advice demanded by Godillot
in the agreement of Bailey & Perkins.

Article 1st

Bailey & Perkins on the one part, Godillot on the
other part agree that M Cunningand Jr. engineer
living in Paris 19 Boul. de Strasbourg will be asked
& give his advice on the patents in question in that
which concerns the formalities relative to these patents
in regard to all other similar patents known
been taken & the possibility of putting these
patents of Gray Edison & Bailey with the
certainty of right in so doing
These titles cleared & advice god been favorable
the delay of a month being the only delay
the Company will be formed legally & clauses
stipulations & conditions as after

1878. Ink for the Blind (NS-78-006)

Drink for the Blind
Sept 2nd 1878

Sheeps Foot	Peppermint	N.G.	Coca Bordeaux — 259.
Petroleum	Cubebs		Ginger (Jamaica) — "
Tennessee oil		"	Dextrine — "
Wintergreen		"	Boiled Linseed Oil "
Sandal		"	Coach Body Varnish Fair
Peppermint		"	Turpentine N.G.
Fennel		"	Asphaltum "
Tansy		"	Castor Oil. Fair
Pennyroyal		"	Balsam Fir N.G.
Rosemary		"	Tallow "
Spruce beer		"	Venice Turpentine "
			Glycerine "
Wormwood		"	Chloroform Fair
Cloves		"	Hydrochloric Acid N.G.
Croton		"	Sassafras "
Bergamot		Fair	Copaiba Balsam "
Citronella		N.G.	Oil Cade "
Goose Oil (Patent)		"	Oil Rhodium "
Anise		"	Hypophosphate Lycopum "
White Thyme		"	Iodide of Zinc Fair
Orange		"	Lactated Quinine N.G.
Juniper Wood		"	Sulphate Strychnine "
Carui		"	Lactate Phosphate Bismuth "
Cassia		"	Bicarbonate of Potash "
Lavender Flowers		"	Acetate Rhyphnine "
N.G. Emulsion			Muriate Chloro Acetic Acid "
Cubebs		"	Liquor Potassa Fortior "
Spearmint			Phosphate Ammonia "
			Sulphate Magnesia "

Gum Arabic "
Bicarbonate of Soda "
Bromide of Potass "
Arsenate of Soda "
Ferrid cyanid of Potass "
Iodide Quinine "
Acetate of Alumina "
Cyanid of mercury "
Tannate of Do "
Sulphate Indigo "
Carbonate Lithia "
Caffeine "
Valerianate of manganese "
Acetate of Silver "
Iodide Cadmium "
Acetate of morphine "
Manganate of Soda "
Tartrate of manganese "
Alum "
Hypophosphate of manganese "
Chloride Nickel "
Tannate of quinine "
proto Acetate of Copper "
Carmine "

Amygdaline "
Sulphate of Iron "
Arsenate of Soda "
Sulphate Quinidine "
Valerianate of Zinc "
Chloride of Lithium "
Sulphate of Cobalt "
Proto Chloride of Tin "
Lupulus "
Iodide of Potassium "
Sulphate of Aniline "
Acetate of Strontia "
Sulph. Carbonate of Soda "
Acetate of Iron "
Sulphate Alumina "
Permanganate Potash "
Manganate " "
Acetate Nickel "
Sulpho. Vinate Sodium "
Tartaric Acid "
Persque Chloride Iron "
Tragacanth "
Acetate Ammonia "
" Strontia "
Lactate of Iron "
Chloride Strontia "
" Ammonia "

Nitrate Sodium	N.O.	Ferrocyanide Potash	N.O.
Sulphate of Cinchonidin	"	Hippuric Acid	"
		Arsenate quinine	"
Uric Acid	"	Citrate Potash	"
Chinic Acid	"	Camphoric Acid	"
Nitrate Uranium	"	Pyrogallic "	"
Chloride "	"	Nitrate of Zinc	"
		Lactate " "	"
Phosphate of Soda	"	phosphoret of Calcium	"
pepsine	"	Oxalate of Soda	"
Iodide Ammonia	"	Acetate Baryta	"
Capsicum	"	Citrate Ammonia	"
Valerianate of Potash	"	tartrate of Potash	"
Carbonate of Magnesia	"	Sulphate Magnesia	"
Alum	"	Molybdaenic Acid	"
Sulphate Copper	"	Formiate of Soda	"
Citrate of quinine	"	Sulphate of Cadmium	"
		Tungstate Soda	"
Formate of Copper	"	Bermuda Arrowroot	"
Nitrate of Strontia	"	Bromide Cadmium	"
Sulphate Cadmium	"	Chloride Cattania	"
Citric Acid	"	Phosphate Ammonia	"
Chlorate Soda	"	Citrate of Potash	"
Bichromate Potash	"	Nitrate Magnesia	"
Sulphate Zinc	"	Peinitrate Iron	"
Tartrate of Soda	"	Tri Chromate Ammonia	Tair
Phosphate Lime	"	Stannate of Soda	N.O.
Nitrate Magnesia	"	Sulpherret of Baryum	"
Chromic Acid	"		

Chloride Alumina	No 1	Bichloride Mercury	No 1
Caustic Baryta	"	Benzoate Ammonia	"
Sulphate Lithia	"	Carbonate "	"
Hypochlorite Quinine	"	Picrotoxin	"
Sulphate Caffein	"	Chloride Barium	"
Sulphite Ammonia	"	Sulpho Carb- of Lime	"
Boracic Acid	"	Acetate Uranium Potash	"
Gallate Ammonia	"	Chloride of Lead	"
Glycerole of Lime	"	Phosphate Magnesia	"
Oxalate Ammonia	"	Acetate Lime	"
Arsenious Acid	"	" Cobalt	"
Iodide of Lime	"	Acetate Magnesia	"
Caustic Potash	"	Chromate Potash	"
Fluoride of Sodium	"	permanganate Sodium	"
Chloride Barium	"	Borate of Copper	"
Baptisian	"	Bisulphate Soda	"
Picate Ammonia	"	tartrate Manganese	"
Benzoate of Soda	"	Acetate Zinc	"
Salicine	"	Ammonia Citrate Zinc	"
Pyrophosphate of Natrium	"	Oxalate Potash	"
Iodide Potass	"	Citrate Magnesia	"
Tartrate of Iron	"	Cyanide Mercury	"
		Hydrate Strontia	"
		Phosphate Manganese	"
		Anthracate of Potash	"
		protochloride Iron	"
		Iodide Barium	"
		Gum Guaicum	"
		Chloride Zinc	"

Asparagin	1 oz
Glycocoll	"
Mannite	"
Nitratt Lime	"
Sulphatt Bebirin	"
Iodide Cadmium	"
Chloral Hydratt	"
Lactic Acid	"
Phloridzine	"
Caustic Soda & Gum Sandarac	"
" " Balsam Copaiba	"
" " Balsam Canada	"
Glycerine	"
Bi tartratte of Potash	"
Caustic Potash & Shellac	"
" " Sandarac	"
" " Benzoine	"
" " Gamboge	"
" Venice Terps	"
Gum Gamboge	"
" Guiacum	"
Mica Cosmic Salts	
Perchlorate Potash	"
Zirma wire	"
Sheet Gelatine	"
Thick Card Board	

Paper saturated with the above and then written on with Arsenic Acid

Chas F Cairns
Wm Carman

Chas Batchelor

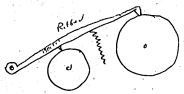
1878. Phonograph (NS-78-007)

Facsimiles prepared for use as exhibits in American Graphophone Company v. Edison Phonograph Works follow all other notes and drawings.

Phonograph

Jany 2, 1878
70 Edison

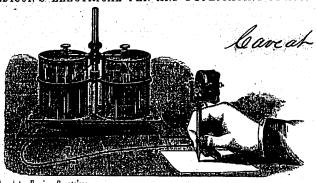
Patented
J Kruesi



Phonograph
for enlarging the record on a recorded
Cylinder by leverage
on Electric Gang on 1st cylinder and
rotated slow to give full time
by act

In reproduction perhaps a thread shaped point
would be best than U and not thin V the sheet
could be cut commercially without effecting
reproduction =

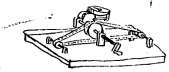
EDISON'S ELECTRICAL PEN AND DUPLICATING PRESS.

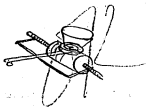


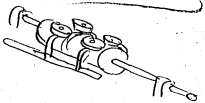
CHAS. RATCHELOR, General Agent for Foreign Countries.
P. O. Box 3207.

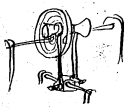
New York, 187

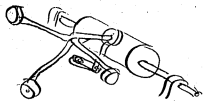
Feb 3 1878









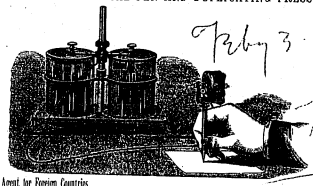


Double record right of R.R.

EDISON'S ELECTRICAL PEN AND DUPLICATING PRESS.

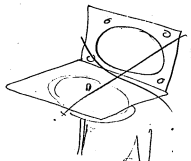
Caveat

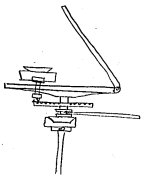
Feby 3 1878

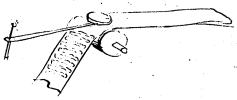


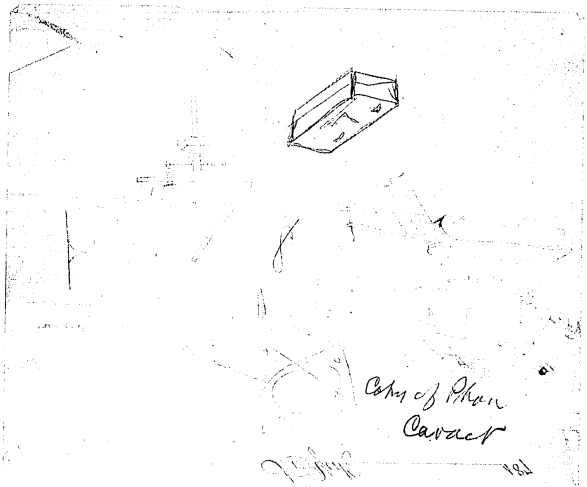
CHAS. BATCHELOR, General Agent for Foreign Countries.
P. O. Box 3207.

New York 187

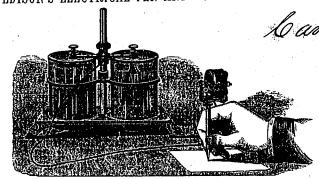






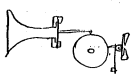


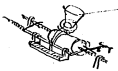
EDISON'S ELECTRICAL PEN AND DUPLICATING PRESS.

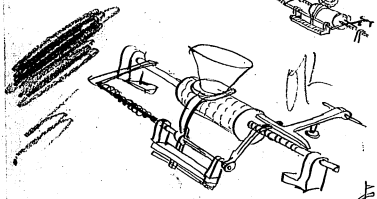


CHAS. BATCHELOR, General Agent for Foreign Countries.
P. O. Box 2207.

New York, 187







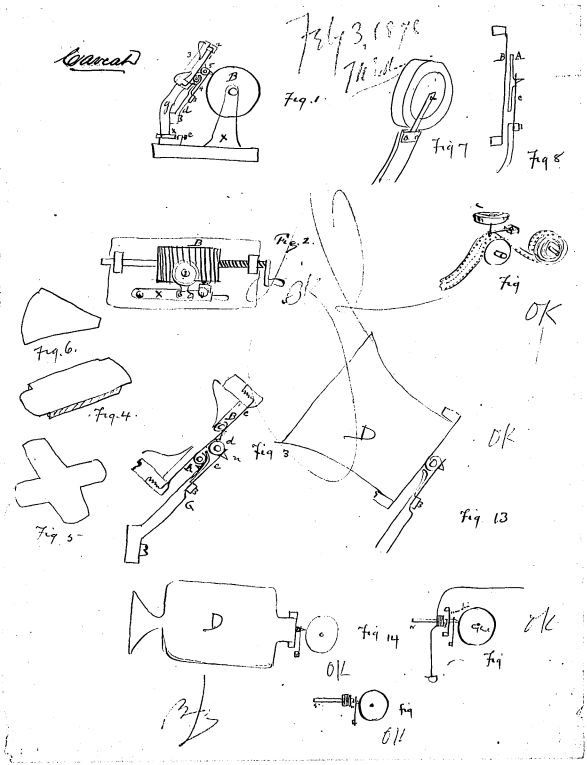
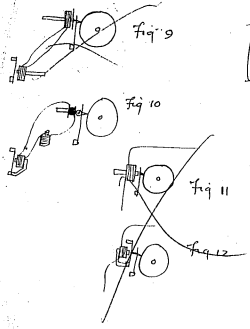


Fig. 1.
Fig 7
Fig 8
Fig. 2.
Fig
Fig. 6.
Fig. 4.
Fig. 3
Fig. 5.
Fig 13
Fig 14
Fig
Fig

Specification



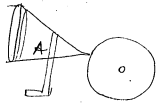
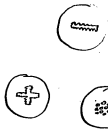


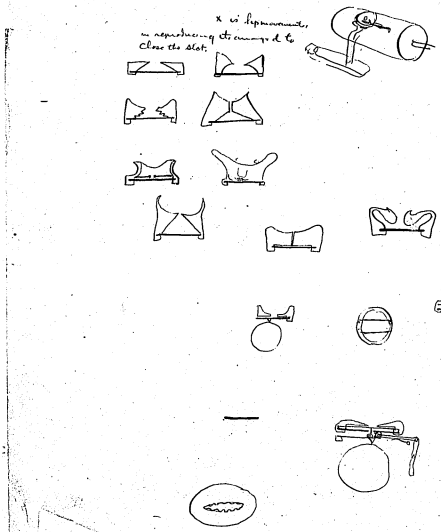
Fig 13



July 3 1878

Photographs -

Feby 8. 1875.
Tarbuck



Caveat

July 3 1876

X

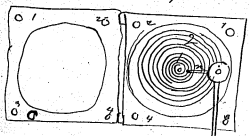


Fig 14

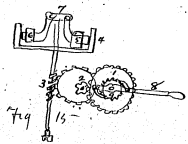


Fig 15

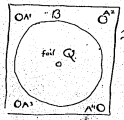


Fig 16

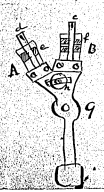
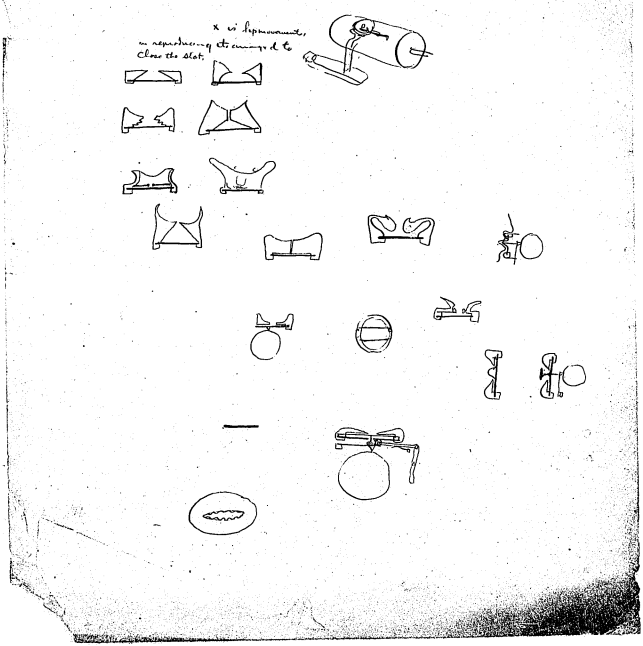
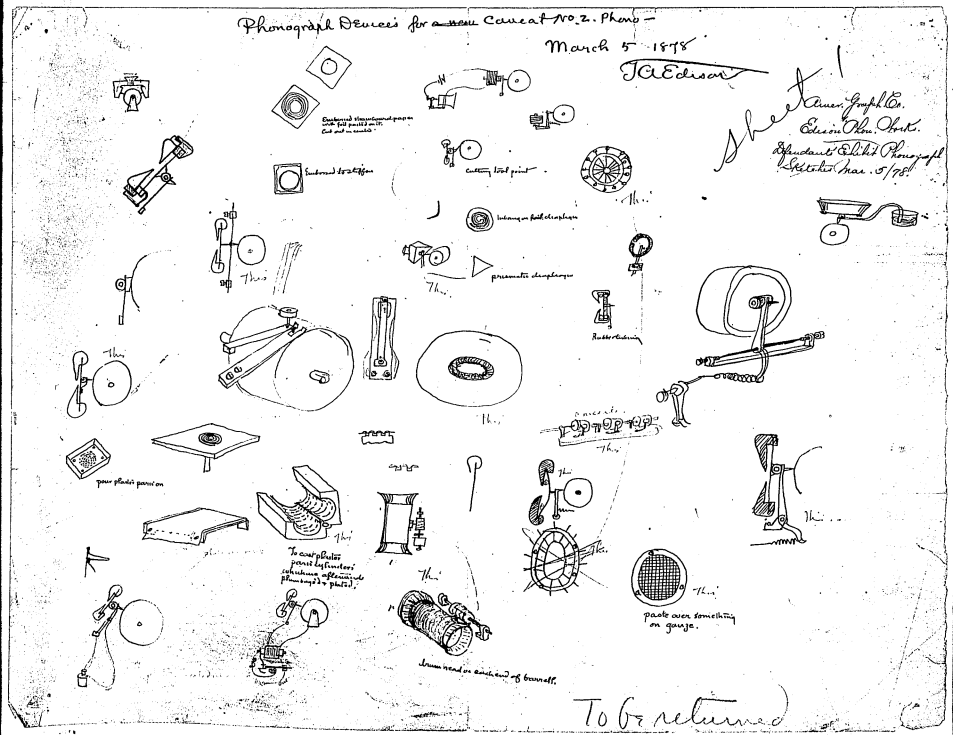


Fig 17

Rhomboid -

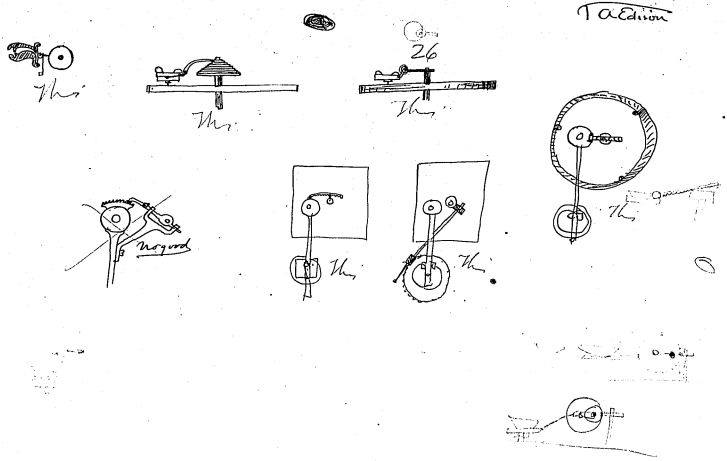
Feby 8. 1875.
Tilden




Phonograph Devices for a new Caveat No. 2. Phono –
March 5 1878
T.A. Edison
Sheet 1
Amer. Graph Co.
Edison Phon. Dept.
Specimen of Etched Phonograph
Sketched Mar. 5/78
Embossed Stereotype
Indenting or point electrophone
pneumatic diaphragm
Rubber Cushion
pour plaster paris on
To cast plaster paris Impressions of Phonograph plates.
paste over something on gauze.
To be returned

Phonograph Caveat No 2. Sheet 2. March 28. 1878

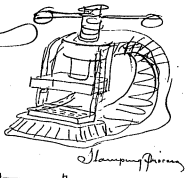
T A Edison

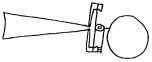


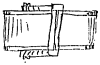
(To be returned)

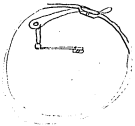
May 10 1878

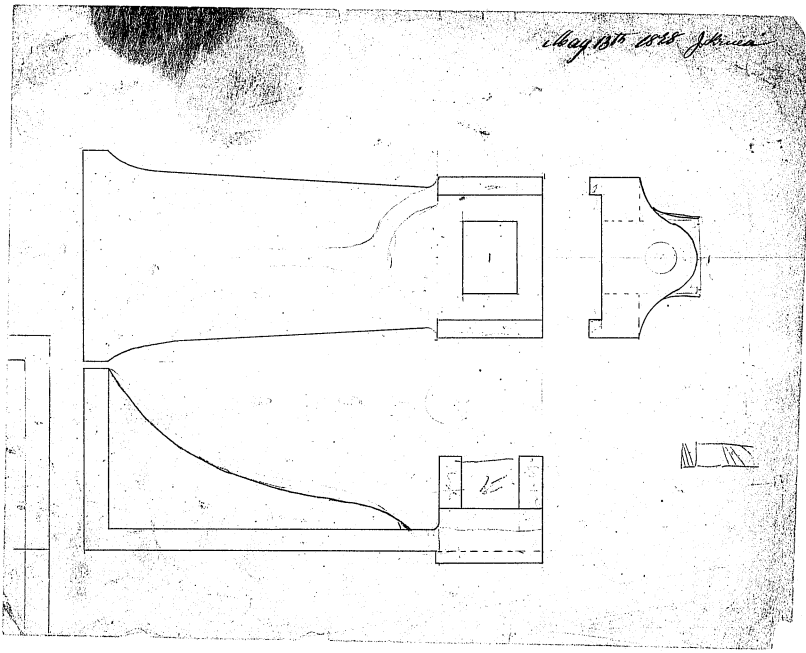
Caveat Phonograph










May 18th 1885 J.K.

T. A. EDISON,

Menlo Park, N. J., 187

Mr Krusi—

Please make me diaphragms for this and mark which way they go on of the following things

X1 Ferrotype plate
X2 Drawing paper
X3 Make 2 of Cork. Thin up stairs
4 Hard Rubber
X5 Writing paper
X6 Soft Rubber 2
X7 Shells brass
X8 Copper (thinnest)
X9 Talcut Leather
X10 Paraffin paper
X11 2 dz paper from roll up stairs so that I can soak them in different things.
X12 One of each thickness of tinfoil

Batchelor

X 1/2 paper dipped in shellac

X 1 " wood

X 1 [illegible]

1 blades

X 1 [illegible]

X 1 [illegible]

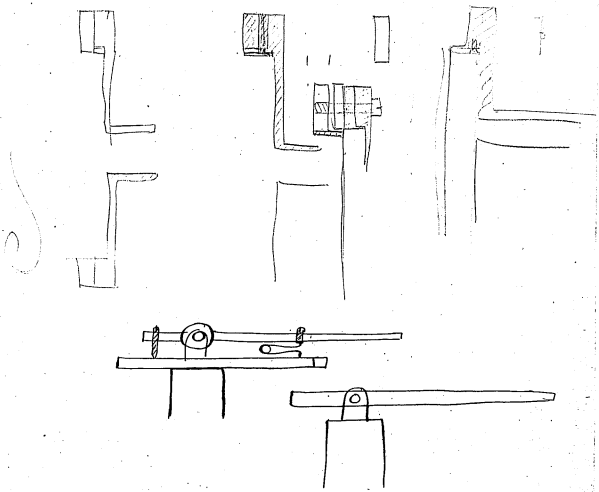
X 1 German Silver

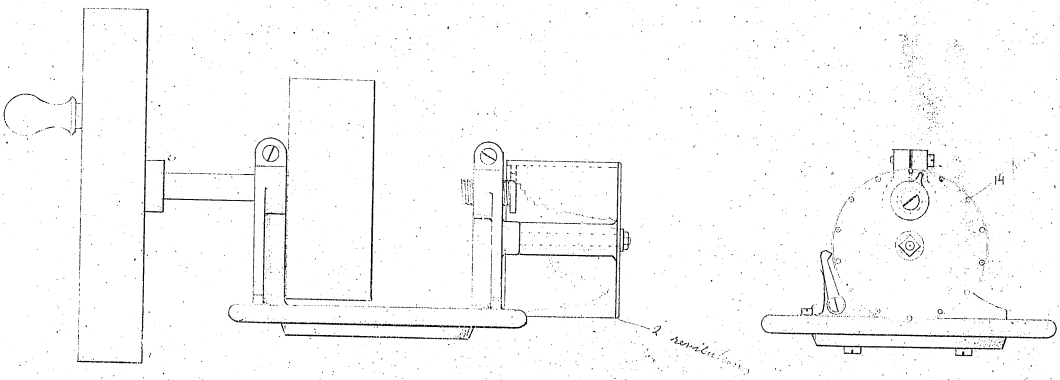
X 1 Steel

Phonautograph

July 10th 1878.

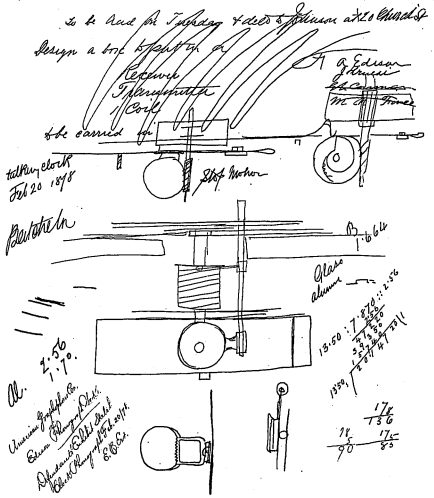
Diaphragm must be stretched

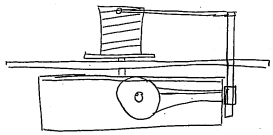




John F. Ha
July 15. 1873

[FACSIMILE]





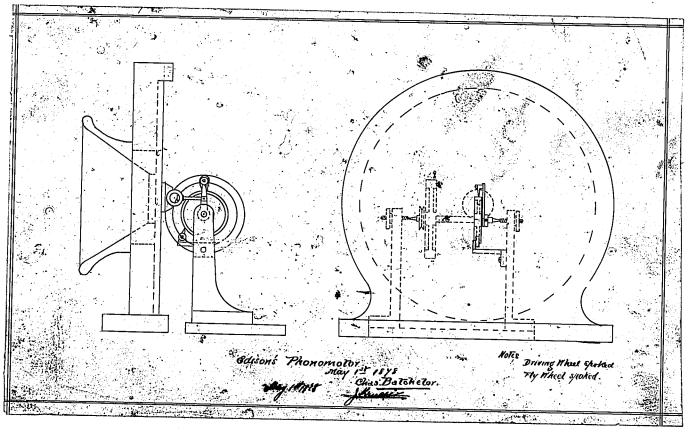
Manuscript Feb 22nd 1878

Sparking attachment for clocks

Drum 4" diam

Chas Batchelor
T A Edison
J Johnson
Chas Batchelor
M M Jones

1878. Phonometer (NS-78-008)

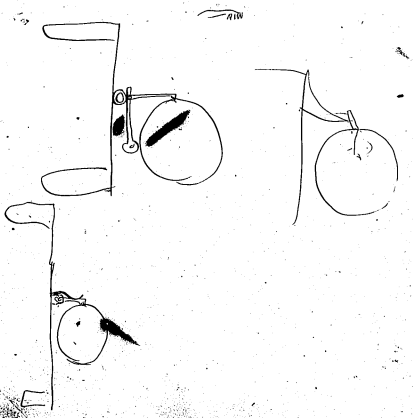

Edisons Phonomotor
May 1st 1915
Chas Batchelor.
May 1st 1915
J. Lawson
Note
Driving Wheel Slotted
Fly Wheel plain.

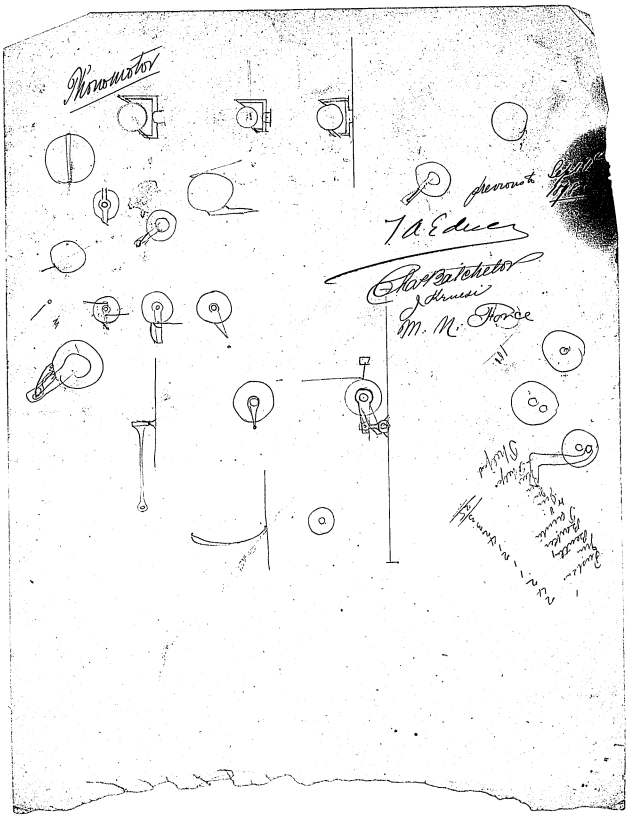
To Edison

Chas. Batchelor
Newark N.J. Sept 1st 1878

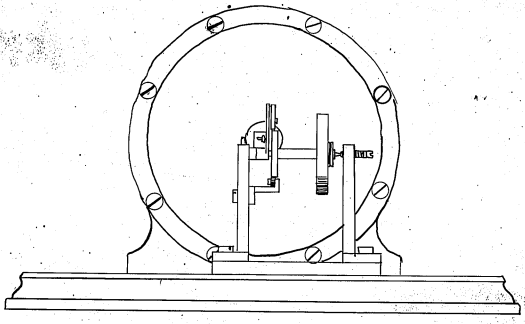
Kinetoscope

M. M. Foote

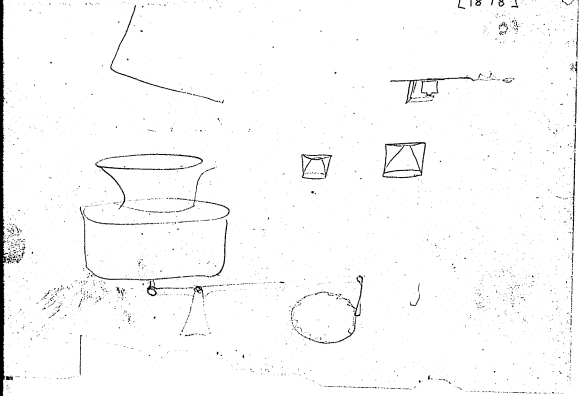


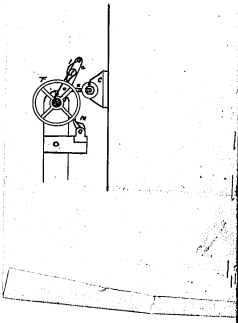

Phonometer
Witnesses
M. M. Pierce

[1878]

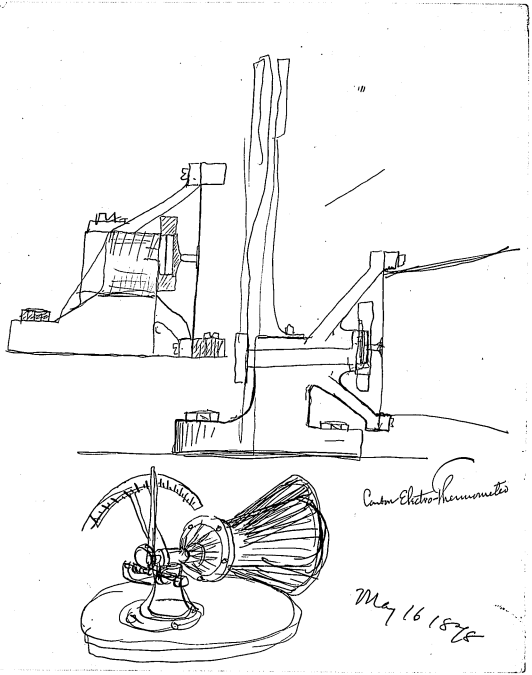


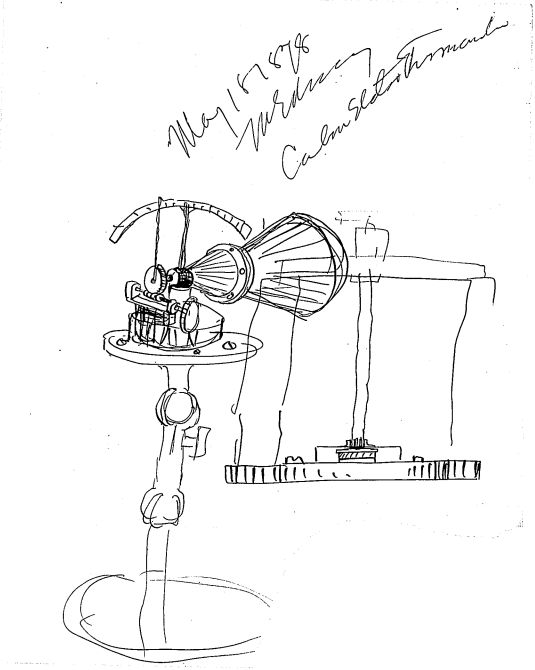
[1878]

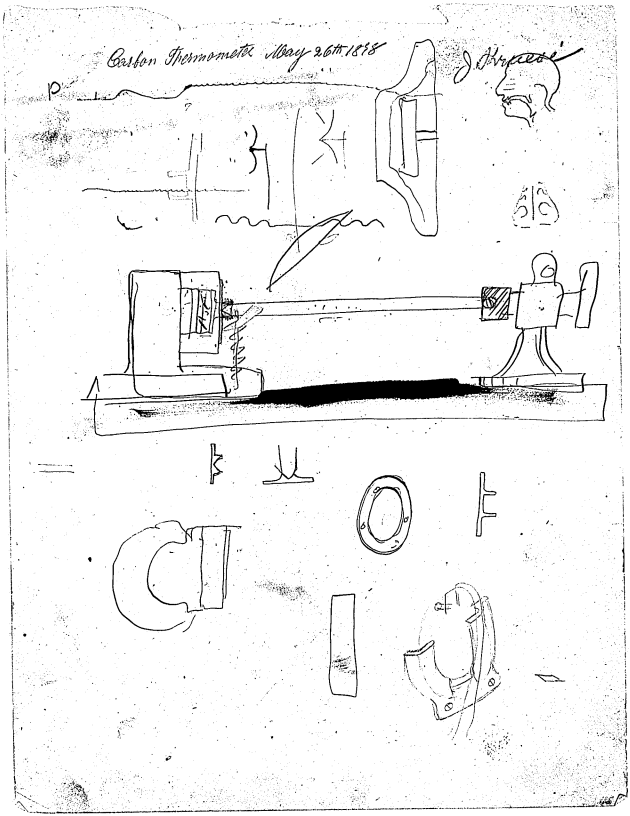


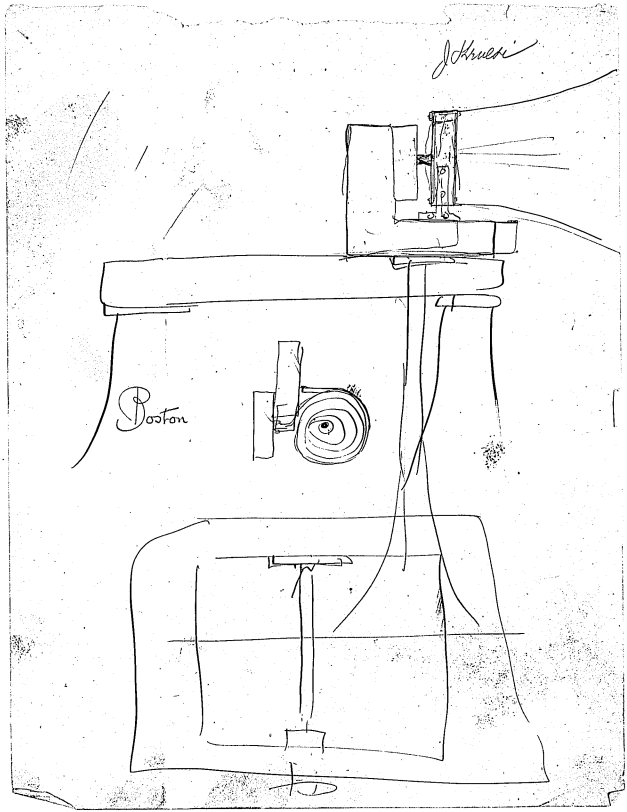


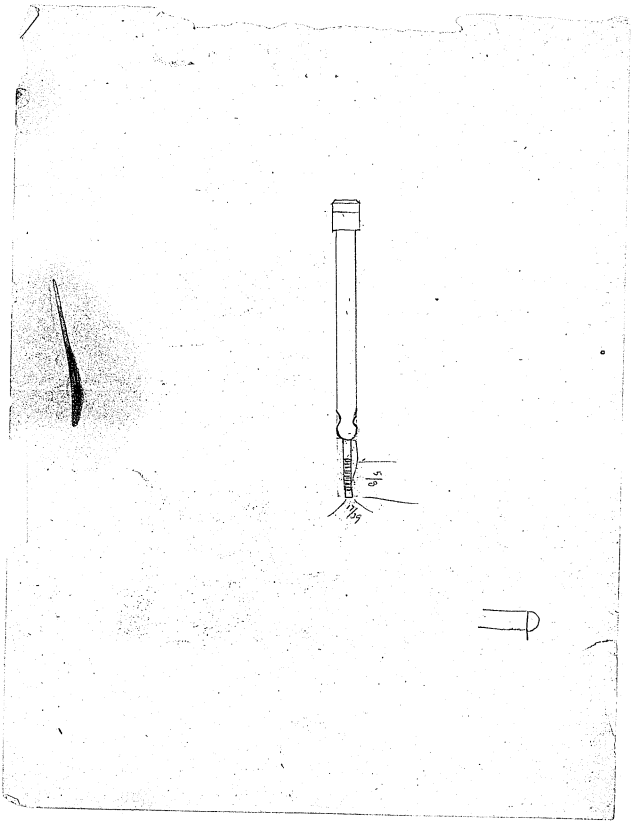
1878. Tasimeter (NS-78-009)


Custom Electro-Thermometer
May 16 1878




Carbon Thermometer May 26th 1838
J. Hopkins


J. Krueger
Boston

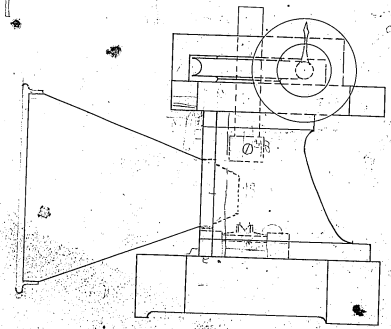


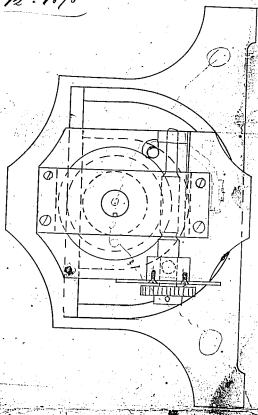
Edison's Micro-Tasimeter

Menlo Park, N.J. June 12th 1878

Chas Batchelor

J. Krusi

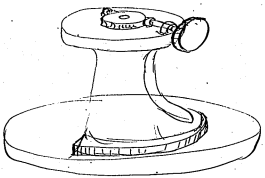




Heat Measurer
Micro-Pesameter

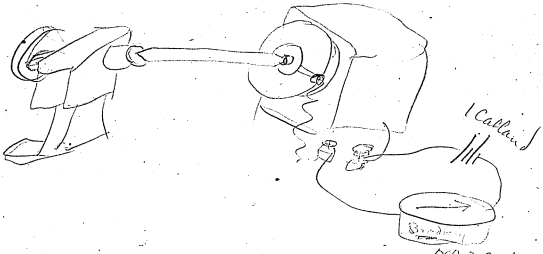
June 12th 1875

Chas Batchelor



June 23 1878
T A Edison

Some experiments with Vulcanized hard rubber in the Tasimeter



Paper soaked in oil membrane & held within 1/8 of inch from steel cameo q to deflect from 45 to 47. (note O Membrane softer in hard rubber in 3 weeks)

Creosote, do from 45 to 46 1/2 —

Carbolic acid, no effect.

Benzine, Circles owing to cold produced by evaporation

Cyanide Potassium expands it from 45 to 47

Chloral Hydrate on cold glass rod makes it go up 1/2 degree

Tincture Iodine cold glass rod 1 deg — tried it after being exposed to air 20 minutes so it must be at same temperature

July 10th [illegible]

Pieces for Instruments

Marsdatchola

3 Allum.
3 Cadm.
3 Copper
3 Iron
3 Nickel
3 Lead
3 Silver
3 Zinc
3 Mica

8 inches 1/32 & 1/16 thick
& 1/16 1/8 3/16 & 5/16 wide

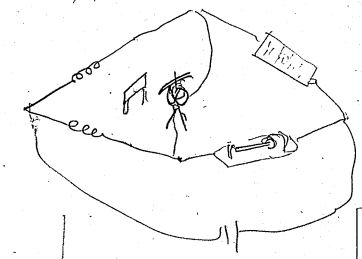
3 Aluminium
3 Cadmium
6 Copper
6 Brass tubes
6 Iron
3 Nickel
3 Lead
3 Platinum
3 Silver
6 Zinc
2 [illegible]

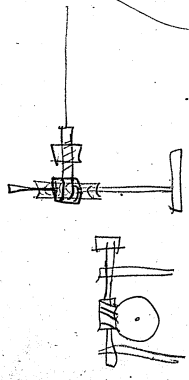
[illegible] 1/16 1/8 1/8 wide
3 Mica [illegible]

1/32 1/16 1/8 3/16
1/8 1/8 3/16 5/16 wide

Tasimeter
1878
Jany

T A Edison
Chas Batchelor





300.

1/100

T. A. EDISON,

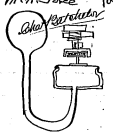
11 Menlo Park, N. J., 1878

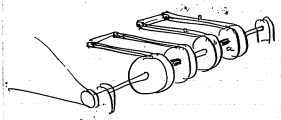
John Kruesi
Made (4) four
Micro Tasimeter.
Chas Batchelor

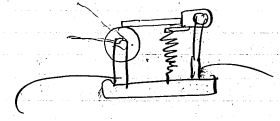
One was finished about 25th of June & given to Boeff.
Jany
One for Mr Edison finished July 11th.
One Mr Lowe " " 18th.

...Menlo Park, N. J., ..., 187

Oct 3rd 1878
7 A E
Edison Griffin
M. N. Price Jacksville, Panama,
Chief Operator







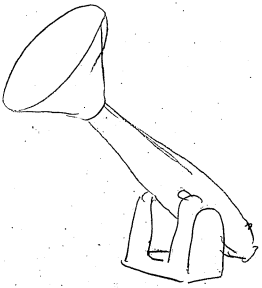
OFFICE OF

WM. L. ASH,

Judge of Probate and County Treasurer,

CARBON COUNTY, WYOMING TERRITORY.

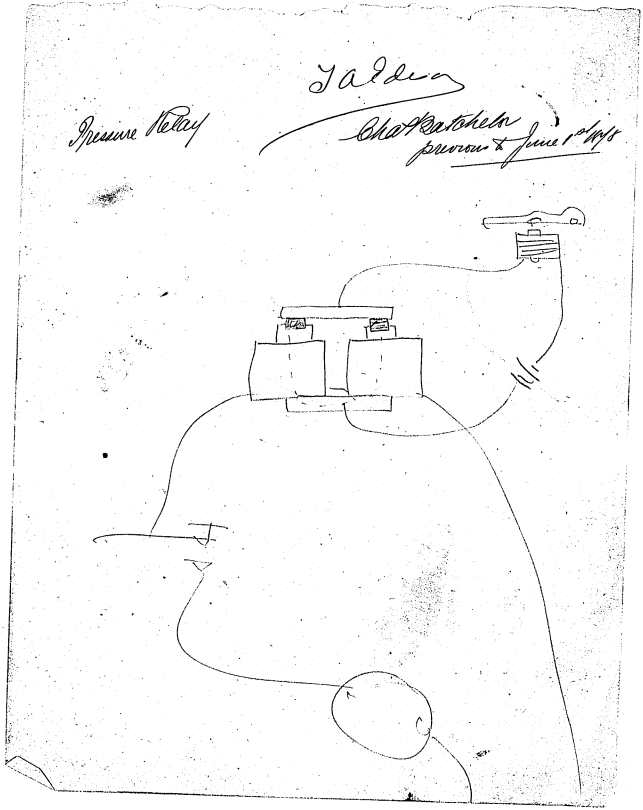
Rawlins, ..., 187...

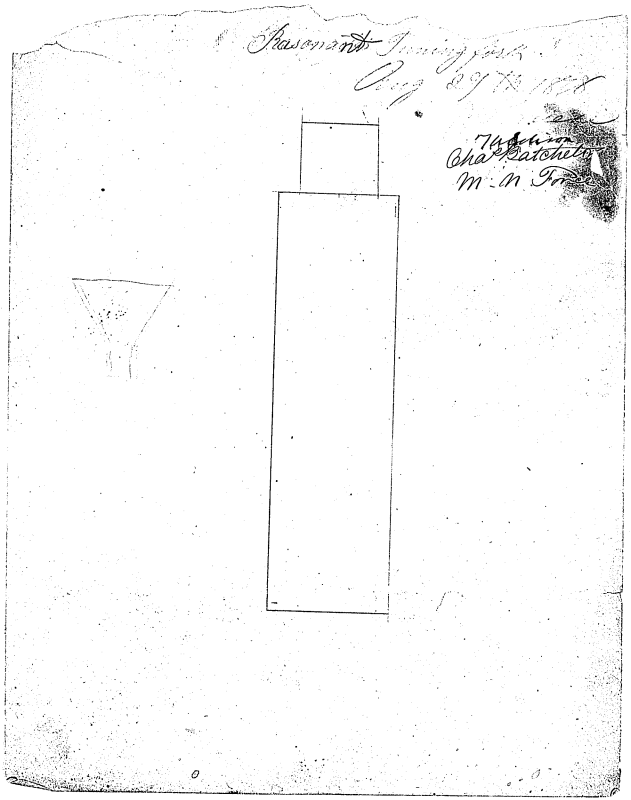


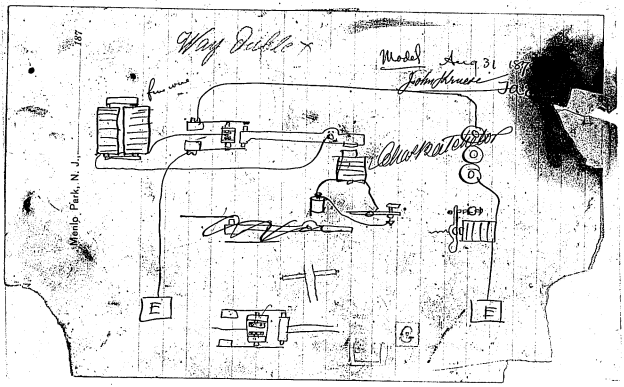
1878. Telegraph (NS-78-010)

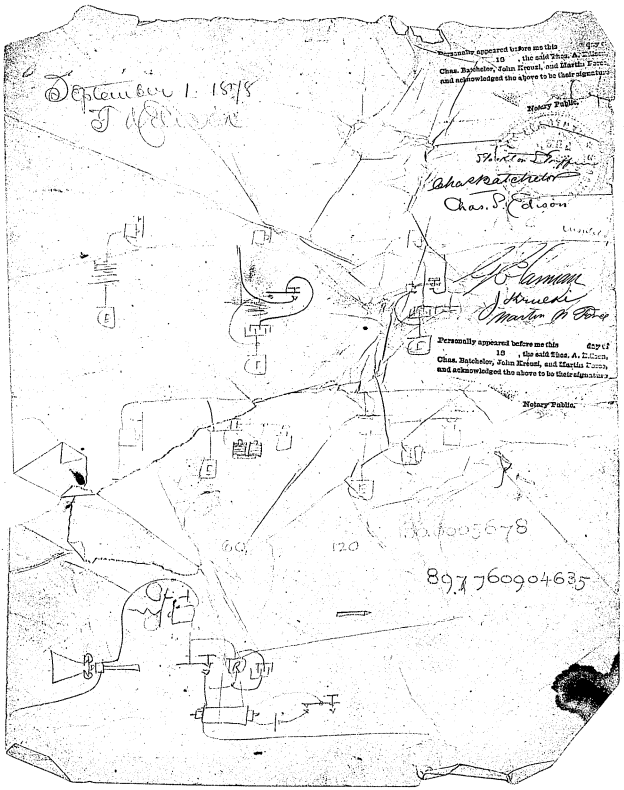
Pressure Relay

Inventor
Chas. Batchelor
per Wm. & June 1st 1898




Basement Drainage
Aug 29th 1884
Thos Jackson
Chas Batchelor
M. M Fr


Way Diddle ×
Model
Aug 31
John Kruse
Menlo Park, N. J.
E
G
E


September 1. 1878
Witness
Witness
Chas. P. Edison
Personally appeared before me this
Chas. Batchelor, John Krusi, and Martin Force,
and acknowledged the above to be their signatures
Notary Public.
120
897760904635

Personally appeared before me this
19 , the said Thos. A.
Chas. Batchelor, John Kreusi, and Martin F
and acknowledged the above to be their signature

Notary Public.

September 1 1878.

Reviewing minutes
for Examiner Fuller
J A Edison

Chas Batchelor
Chas. L. Edison

Master in Force

Condenser

Personally appeared before me this day of
19 , the said Thos. A. Edison,
Chas. Batchelor, John Kreusi, and Martin Force,
and acknowledged the above to be their signature

Notary Public.

Condenser

Condenser

Sept 1 1885 JAEd

Chas Batchelor

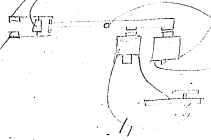
Chas. E. Edison

WC

GE Carman

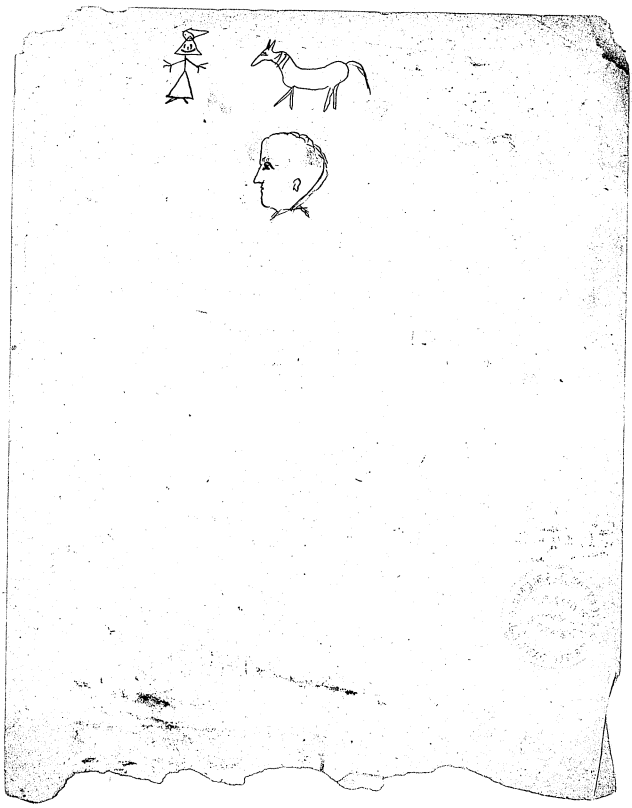
J Krusi

Martin Force



Personally appeared before me this day of
10 , the said Chas. A. Edison,
Chas. Batchelor, John Krusi, and Martin Force,
and acknowledged the above to be their signatures

Notary Public.



Personally appeared before me this day of
19 , the said Thos. A. Edison,
Chas. Batchelor, John Krusi, and Martin Force,
and acknowledged the above to be their signature

Notary Public.

Chas. Batchelor
(Mass.) Edison

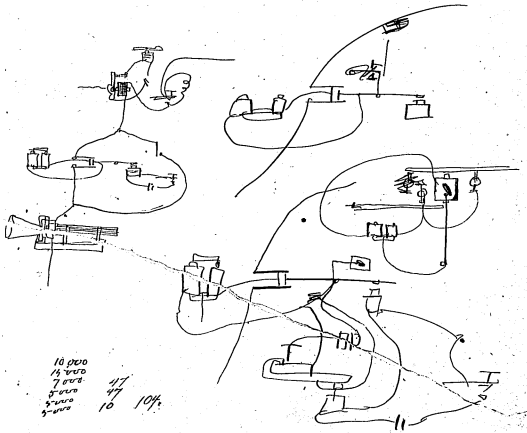
Personally appeared before me this day of
19 , the said Thos. A. Edison,
Chas. Batchelor, John Krusi, and Martin Force,
and acknowledged the above to be their signature

Notary Public.

Sept 1915 Taldrom crew Dunley

J. Lincoln

Observatories

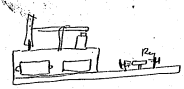


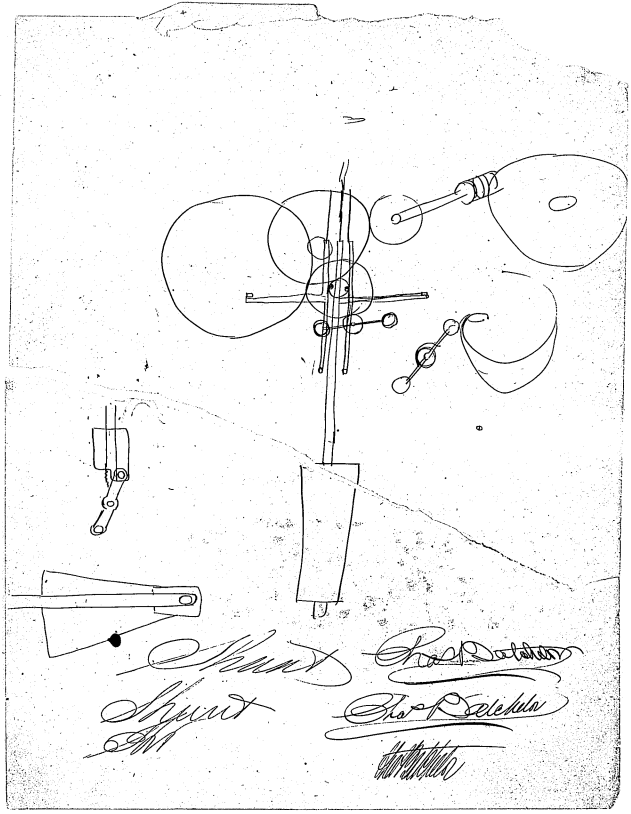
10 000
15 000
7 000
4 000
3 000
2 000

17
17
10
104

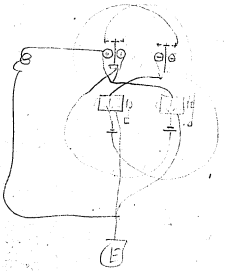
Portland Portland

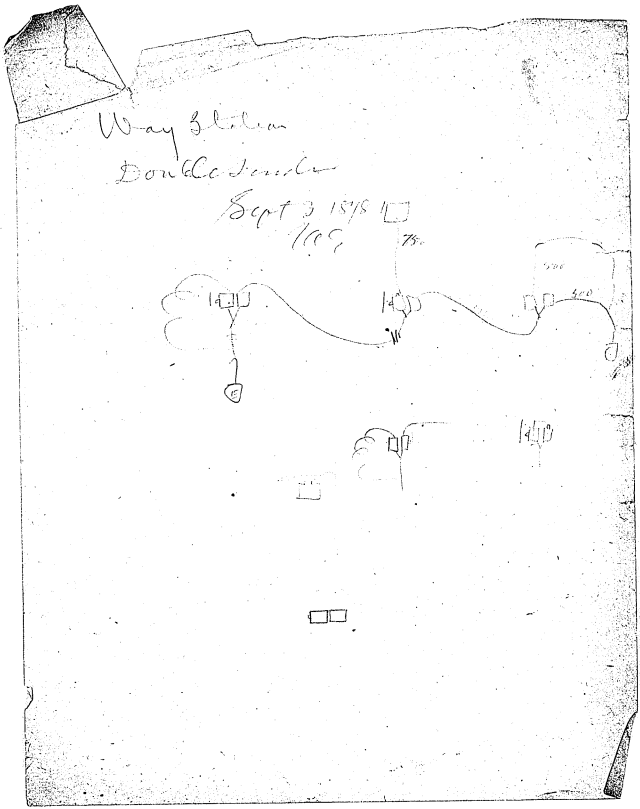
Portland Portland

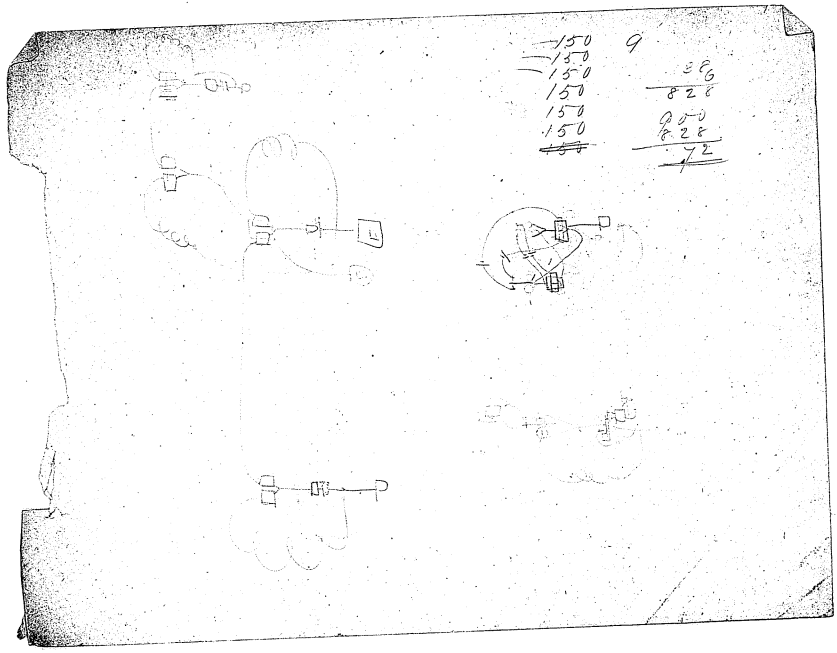




Way Duplex
Sept 3 1878




Way Station
Double Track
Sept 3 1878
100
75
300
400

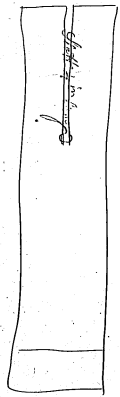

150
150
150
150
150
150
9
336
826
950
826
72

Edisons Tuning Fork. Resonator

Sept 13th 1877

T A Edison
Chas Batchelor
J Kruesi
M-M Force

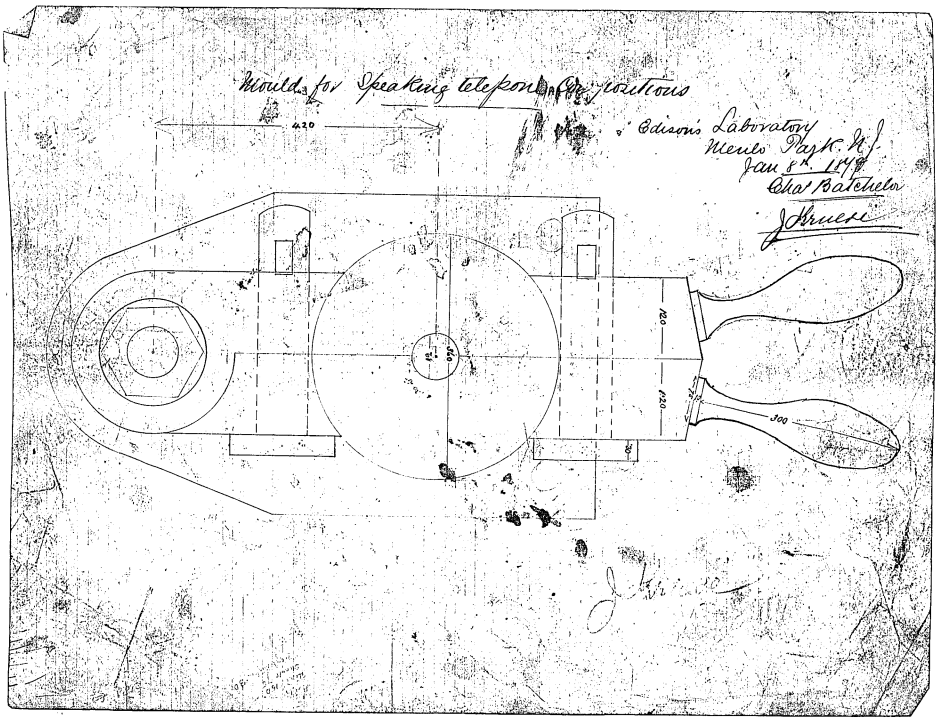
Mr Kruesi Will you make from pen wheel tubing a fork.



Length of tube about 18 inch.
Length of slot at first 4 inch.
plug up the hole at the end to hold water

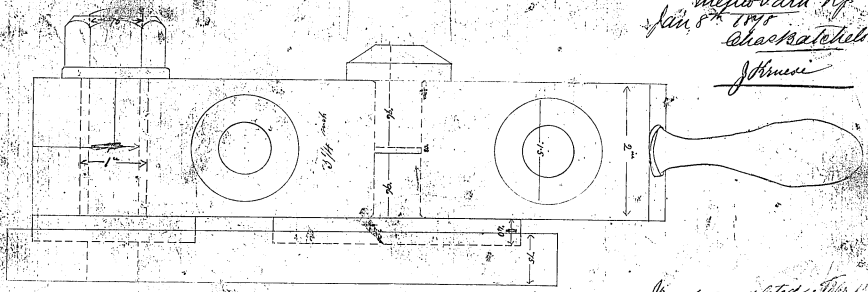
1878. Telephone (NS-78-011)

Moulds for Speaking telephone Mr. Courtois



Edison's Laboratory
Menlo Park N.J.
Jan 8th 1879
Chas Batchelor
J Kruesi

Model for Speaking telephone Composition. Edison's Laboratory
Menlo Park N.J.
Jan. 8th 1878
Charbatchelor
J. Kruesi

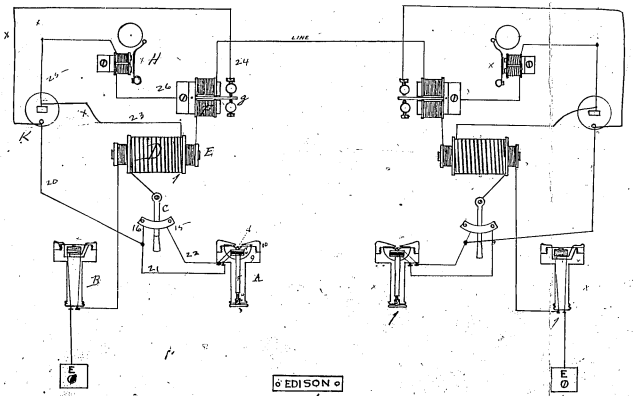


No. 1. completed Feb. 15 78
No. 2. " Augt. 5th 1878

Case No 157

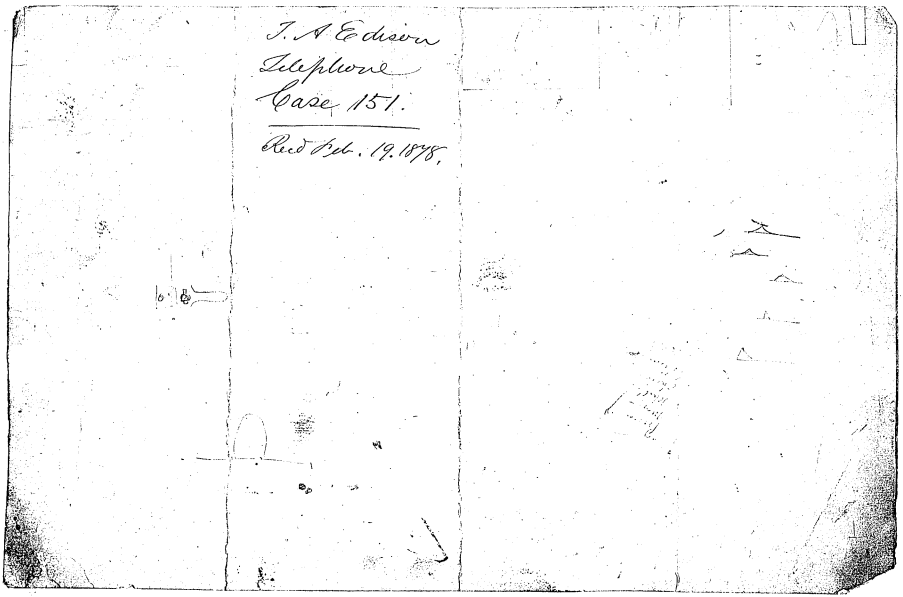
Station No 1.

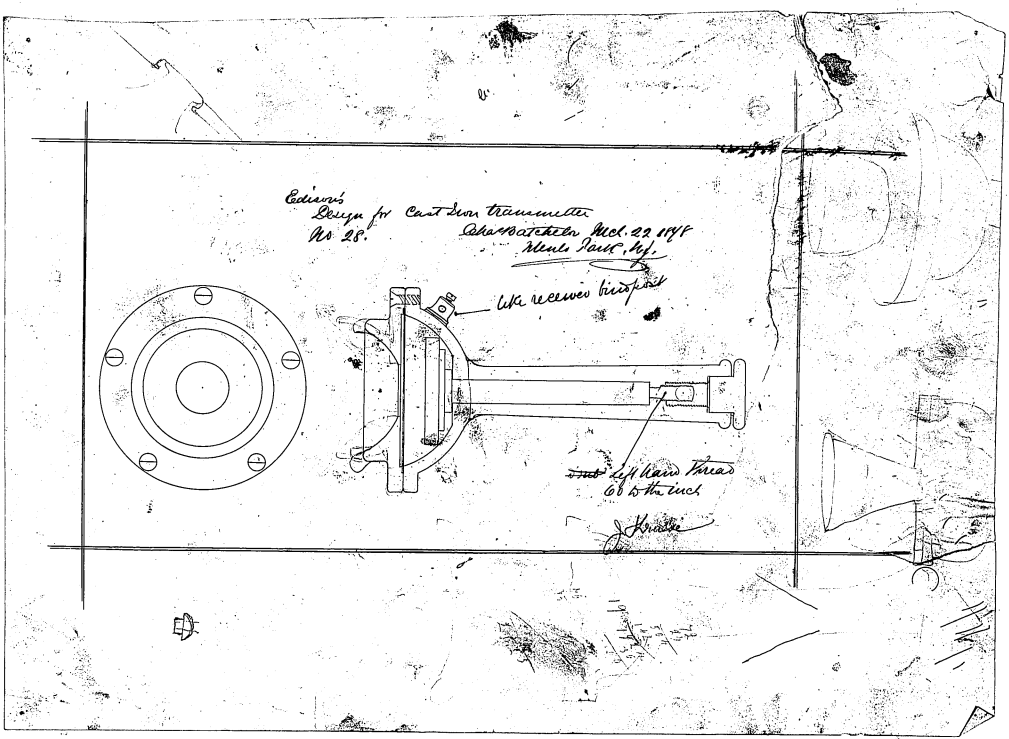
Station No 2

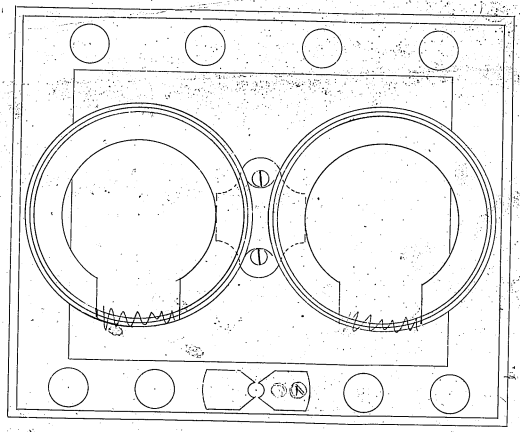


Patent Office Model for
Edisons Speaking Telephone
Menlo Park, N.J. Feb 4th 1878.
Chas. Batchelor.

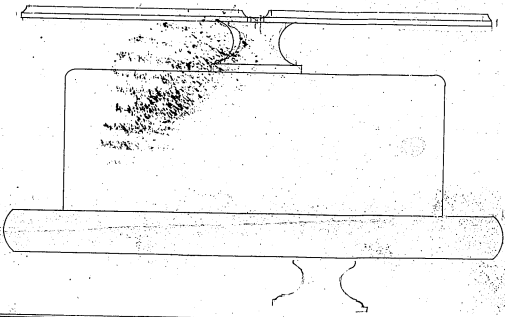
Finished Feb. 13. 1878 [illegible]

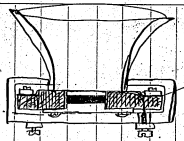

T. A Edison
Telephone
Case 151.
Rec'd Feb. 19. 1878.


Edison's
Design for Carbon transmitter
No. 28.
Orange, N.J. Mch. 22 1877
Menlo Park, N.J.
Like received Dec. 24th
Left Hand Thread
60 to the inch.



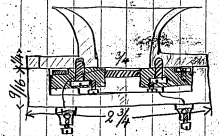
Bracket for Telephone rest on one box
Edwin's Speaking telephone
May 2nd 1918
No 46
Chas Batchelor
Inv'r 1918 John Kruesi





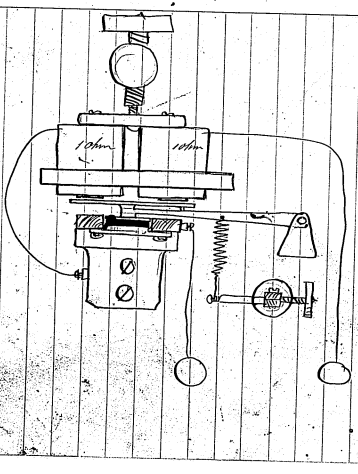
thin sheet rubber stretched across & slits cut out

Direct Telephone
Russell
June 21 1878



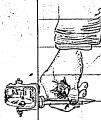
opp inside 2 7/16 3/8 Do

Thomas A Edison
Chas Batchelor
Jos Mevey



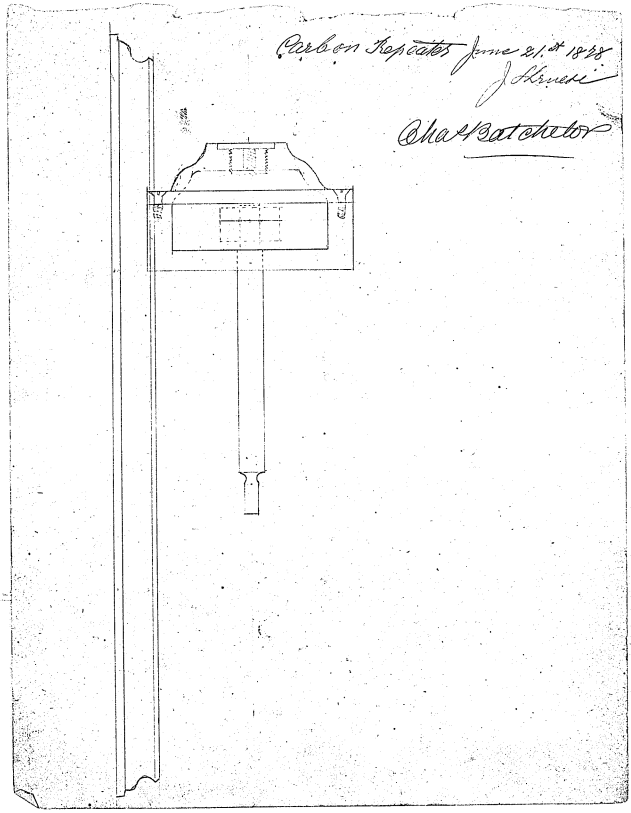
Automatic Current Regulator
with magnet and Carbon
June 21 1878

Thos A Edison
Chas Batchelor
J. Howell



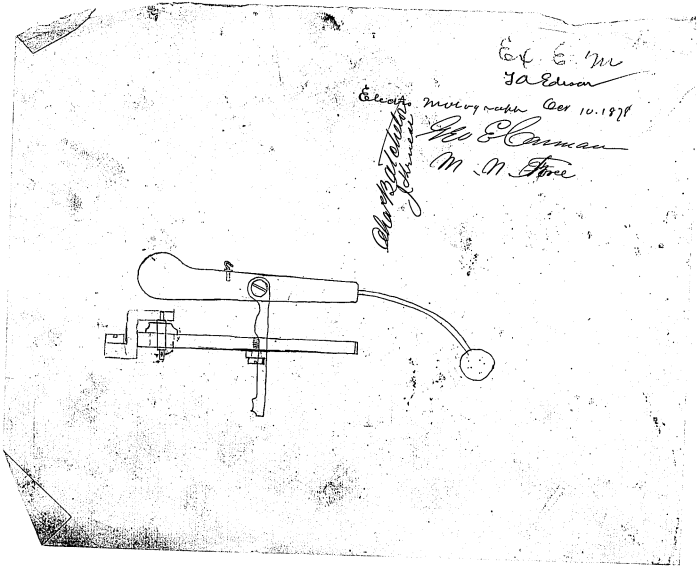
Rib on Respirator June 21st 1858
J. Stevens

Chas Batchelor



Spaltung Stellung

Num.	Diaphragma in Incisiva	Diaphragma con Foramen Nutritio	Foramen Nutritio	Foramen palatinum anterius	Canalis Incisivus mandibulae	Prognati	Remarks.
1.	Fiss.						
2.							
15.	Fiss.						
16.							
17.							Pasiv Obtus
19.							
20.							Pasiv Passo


Ed E. Nn
Ta Edison
Electric Meter
Witnesses
Oct 10. 1878
Geo E Barnes
M N Stone

Elec. 716

Electro Motive Graph Co. 1919 J. Rhuesi J. L. Quinn

Wire 1" long ⅛ square

.0005 .0005 .0005 .0005

Charles Barker G. E. Barnes

8/2000 8/3250 M. Apple Force

6 16. 25.

¾ Yd

2000 feet 12 wires.

7 1 1 0 0 6 2 5 0 0

6 2 5 0 0 2 1 0 0 0 8 1 2 5 0 16 6 2 5 0 8 1 2 0 0

781·250

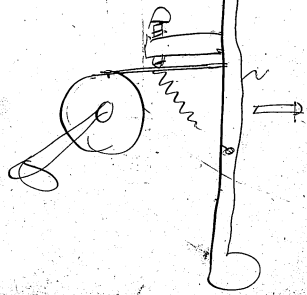
.4567 2·2701

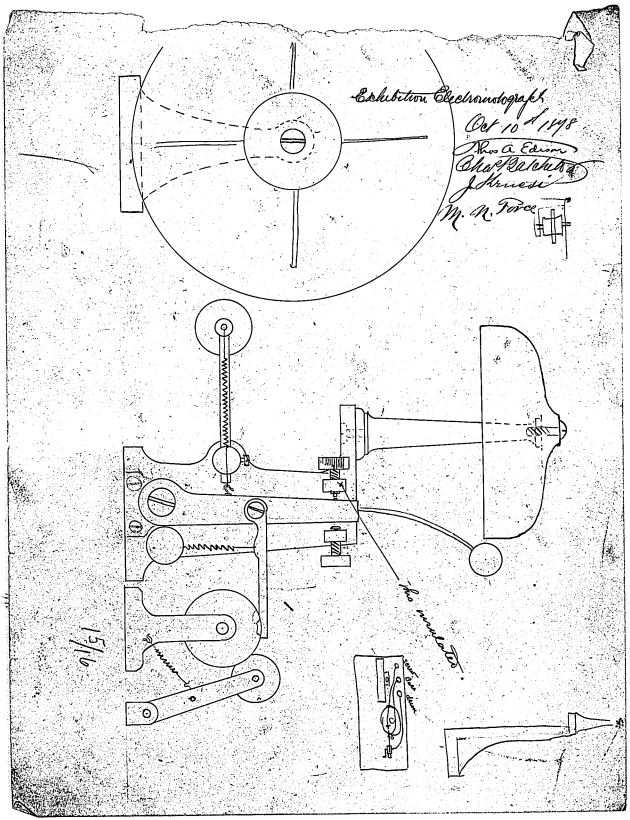
30 24 60 6 2½

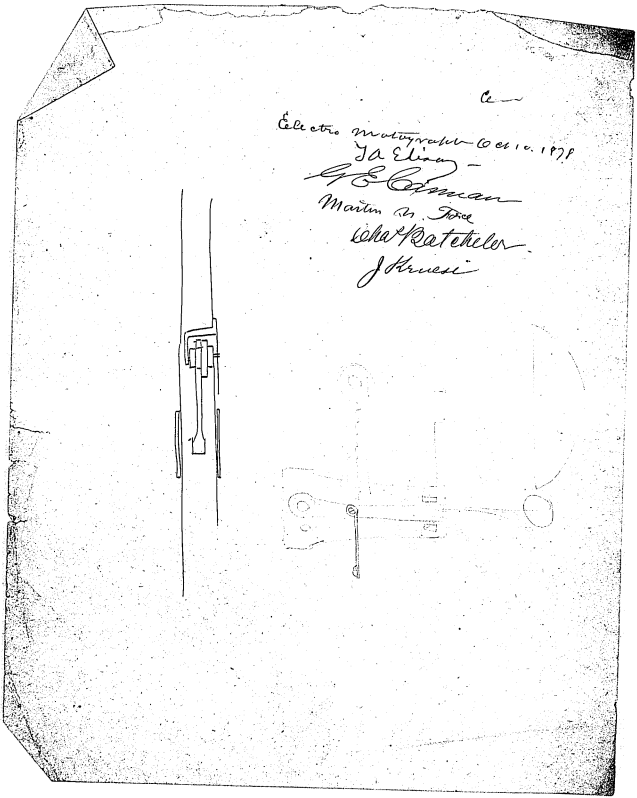
781·250 250·000

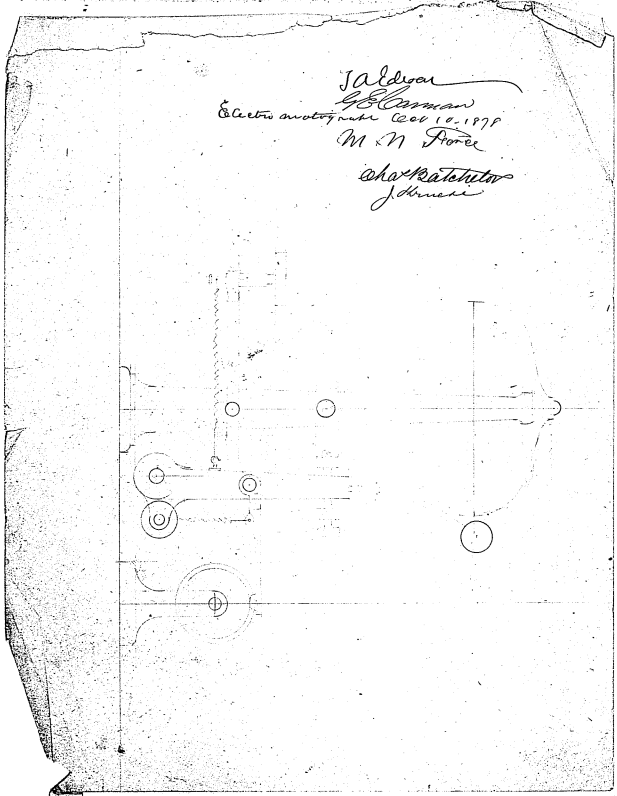
Cost of poles for 25 stations Mathews $12 00 00

25 00 12 00 00 75 00 00 12½ 2½




Exhibition Electromotograph
Oct 10 1878
Thos A. Edison
Chas Batchelor
J. Kruesi
M. R. Force
Fig 1/16
Adjusting screw
Set screw
Thumb screw


Electric Motor
Oct 10, 1871
Ja Elias
G E Corman
Martin Co. Texas
Chas Ratchelor
J Kruesi


S Aldrich
G B Carman
Electric motor made Oct 10, 1878
M N Power
Chas Ratchelor
J Hunnell

[CONTINUED ON THE NEXT FRAME]

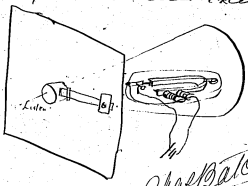
[CONTINUED FROM THE PRECEDING FRAME]

1878. Voltameter (NS-78-012)

Numbered pages 1-22, which precede the other notes and drawings, were copied into Experimental Researches, Vol. 4, pages 175-192. The first page in this series seems to relate to an acoustic device rather than to the voltameter.

June 21 1877 at Edison

Narrow aperature leading from a Continuous Source of Sound & Expansion chamber Johnson
Closer aperture to ground & Lesser Extent Martin Ford



Chas Batchelor

The Slat may be the same as aspect described and may be opened & closed by a magnet galvanometer needle etc or by a strip throwing motion from a diaphragm, having a Concave Convex

Personally appeared before me this 19 day of June, 1878, the above named Chas. A. Batchelor, Chas. Batchelor, John Kruesi, and Martin Ford, and acknowledged the above to be their signatures

Notary Public.

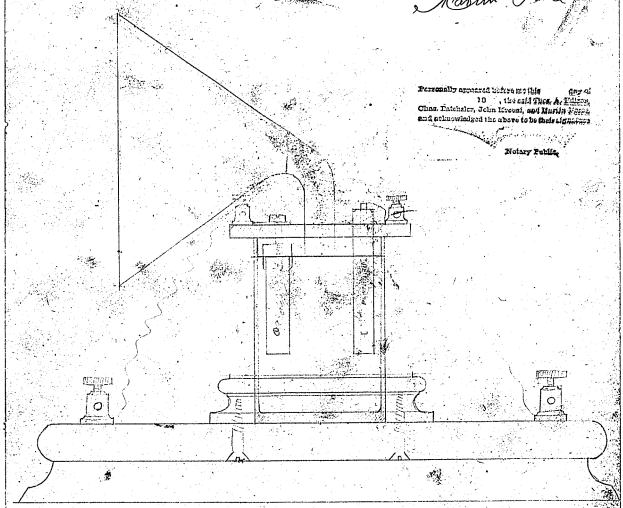
Copied on page 175 Bk 11 Entry Records
Nov 6, 1878
W Lawson

Sonorous Voltameter Aug. 22, 1848.

Copied on p. 78 Vol 4 Ext Researches Elect. 1859

Personally appeared before me this day of 18 , the said Thos. A. Edison, Chas. Batchelor, John Krusi, and Martin Force, and acknowledged the above to be their signatures

Notary Public



Voltameter

Aug 29 1878 3

Edison's

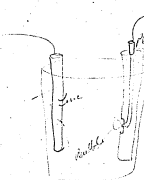
Chas Batchelor

Johnson

Mitchell Instrument made so

Jas Adams

Morgan M Stone



On Strap

1 Drop released in 10 seconds

" " " " 12 "

" " " " 13 "

" " " " 14 "

" " " " 14 1/2 "

" " " " 16 1/2 "

" " " " 14 1/2 "

" " " " 14 1/2 "

" " " " 14 1/2 "

" " " " 14 1/2 "

" " " " 13 1/2 "

" " " " 13 "

" " " " 13 "

" " " " 12 1/2 "

" " " " 12 1/4 "

" " " " 14 1/2 "

" " " " 16 1/2 "

Personally appeared before me this day of 18
and acknowledged that the above to be their signature

Notary Public.

3 cells Carbon 1/2.

in it

160 6.5 115.

16 12 8 6 4

13 1/2

Edison Jr 1/2 Dr

Edison Receiver Ben 9.95 Mitchell

Johnson

After this we put in current 100 ohms

1 Drop in 12 1/2 seconds

Now 30 ohms in circuit

1 Drop in 16 seconds

" " " 13 seconds

Voltameter (Continued) Aug 29 1898

Chas Batchelder
Jas Edes
Martin Flora

With one hundred ohms in circuit

1 Drop in	16½	seconds
1 Drop "	16½	"
1 Drop in	17½	"
1 Drop "	16½	"
1 Drop "	15¾	
1 " "	16	
1 " "	16¾	

Personally appeared before me this day of 10 , the said Thos. A. Edison, Chas. Batchelder, John Howard, and Martin Force, and acknowledged the above to be their signature(s)

Notary Public.

16.5

With 200 ~~ohms~~ ohms

1 Drop in	20	seconds
1 " "	20¾	"
1 " "	19¾	"
1 " "	19¾	"
1 " "	20	"

With 400 ohms in

1 Drop in	27	Seconds
1 Drop in	26½	Seconds

With 600 ohms in

1 Drop in	34	Seconds
1 " "	34	Seconds
1 " "	34¼	Seconds

With 1200 ohms in

1 Drop in	54¾	Sec
1 " "	53½	

Returned from Judge Howard U. S. Circuit Court Dec. 9. 1898 to Committee

Voltameter Continued

With 2400

1 Drop in ——— 86¼ Seconds
1 Drop in 87 Sec.

Chas Batchelor
T A Edison
J Kruesi
Mann Force

With 4800 ohms in
1 Drop in 139 Sec

With 9600 ohms in
1 Drop in 254½ Sec
1 " 245
1 " 251

Personally appeared before me this 16th day of January A.D. 1888 Thomas Park Jr. Notary Public, Chas. Batchelor, John Kruesi, and Martin Force and acknowledged the above to be their signatures

16 Notary Public

16 : 20
16 : 70 : 54 : 00
16 | 6

30 : 44 86½
34 : 44 86½
34 | 1 0 4 139

Entire subject matter of this Book is my Exclusive property and Copyrighted Oct 6. 1887 Thos A Edison

Ohms Shunt	Mean	13½
10 ohms		12½
30 ohms	(mean)	14½
100 "	(mean)	16½
200 "	mean	20
400	"	26¾
600	"	34
1200	"	54
2400	"	86½
4800	"	139

Voltameter

With 600 ohms a

1 drop in 30 sec
1 " " 31 sec
1 " " 32 sec
1 — 33¼ sec
1 — 33½ sec
1 — 34 sec
1 — 33½ sec

Thomas A Edison
John Trowbridge
Marion Force

Platinum cell 600 ohms
1 drop in 16'8 seconds

Nearly 5 times as long as with 3 cells
probably due to polarization + reversion Investigate!

1 drop in 164¾ seconds

Platinum Callaud cell 600 ohms
1 drop in 12 minutes 7½ seconds

Confirmed on P. 150 Vol. I
Exp. Researches on Elect

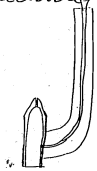
Charge Galvanometer

Edison's
Voltameter.

Aug 21st 1878

Chas Batchelor
J Kruesi
Jas Adsit
Martin Force

This is the boss way for the gas to come from the Electrode



No the pressure will always vary much

Chamber ——

Personally appeared before me this [illegible] day of
18 the said Thos. A. Edison,
Chas. Batchelor, John Kruesi, and Martin Force,
and acknowledged the above to be their signatures

Notary Public.

Received on hand & for Use of Exp Laboratory
Dec 9, 1878 W Conman

8

Bubble Vaccinator Sept 13 1878

Time; 3 cells called and shut ok

#04##P

T.A. Edison
Chas Batchelor
J. Kruesi
Martin Force

Personally appeared before me this 13 day of Sept 1878 the said Chas. A. Batchelor, John Kruesi, and Martin Force and acknowledged the above to be their signatures

Notary Public

Copied in Book 18 Vol 4 Pg Roman
Sept 9, 1879 Pg Roman

6 1/4
6 1/4
6 1/4
6
6 1/4
6 1/4
6 3/4
6 1/4
6 1/4
6 1/2
7 1/2

fine bubbles commence once between large bubble
Shows the construction -
Closed part of the bulb up to
forever the above

6
6
6
5 1/4
5 1/2
5 3/4

Wallamette Continued Sept 15, 1884

T A Edson

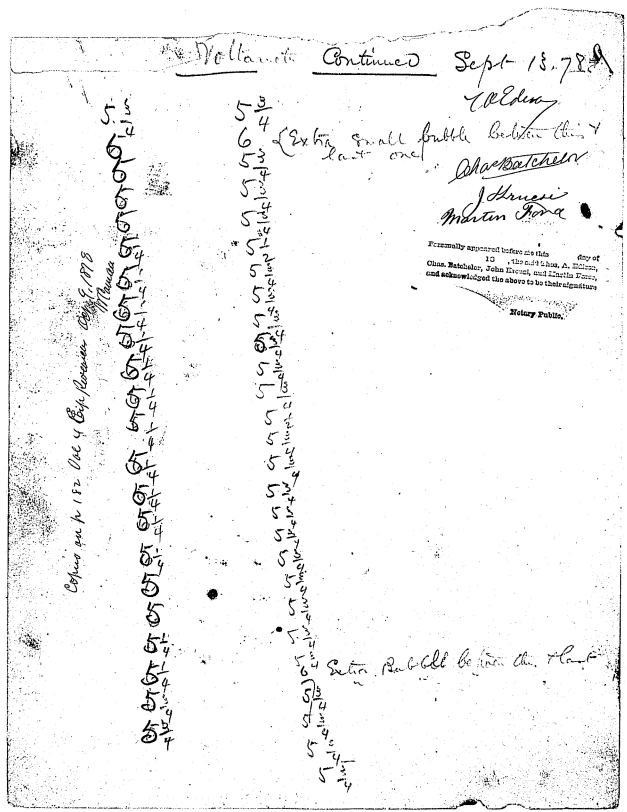
Chas Batchelor

J Hruesi

Martin Roma

Personally appeared before me this day of 10 , the said Chas. A. Batchelor, John Hruesi, and Martin Roma, and acknowledged the above to be their signature

Notary Public.



Bubble Volcanello

Continued

Sept 13. 78

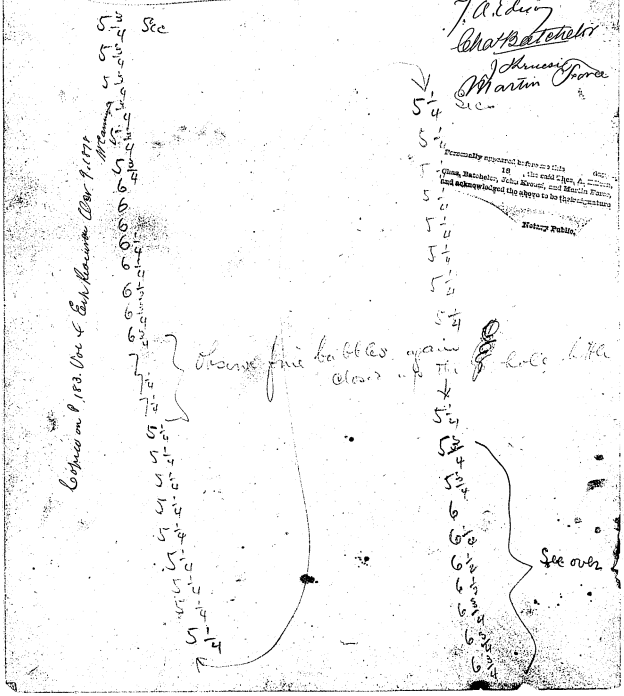
10

J. A. Edison

Chas Batchelor

J Krusi

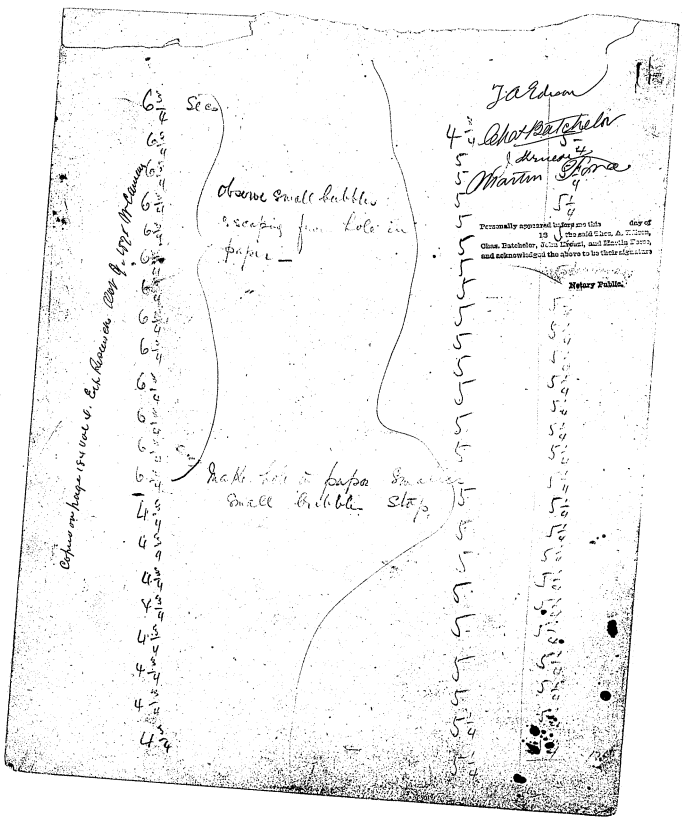
Martin Force

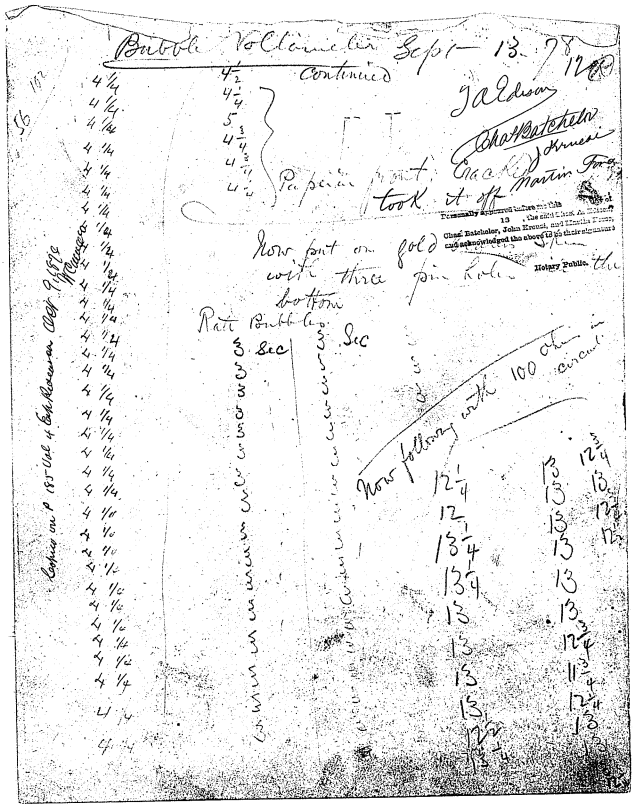


Personally appeared before me this
18 , the said Chas. A. Batchelor,
and acknowledged the above to be their signatures

Notary Public,

Copied on P. 103 Vol 4 Experimental Book Sept 9, 1878


Observe small bubble escaping from hole in paper
Personally appeared before me this day of 19 the said Chas. A. Wilson, Chas. Batchelor, John Lyford, and Charles Sears, and acknowledged the above to be their signatures
Notary Public.


Bubble Vol Claim Sept 13. 78
Continued
Personally appeared before me this 13 the above named A. Edson, Chas. Batchelder, John Krenzel, and Martin Foss, and acknowledged the above [illegible] to be their signatures
Notary Public.
Row put on, fold with three pin holes bottom
Row following with 100 ohms each

Bubble. 9 Mandrin

Sept. 13

Test Electromotive force

3 Cell Ballard Small Size 100 Ohm Constant

Sec. each average 13 Sec

3 cell Carbon 100 Ohm Constant

Formerly appeared before me this day of 15 , the said Chas. A. Ehlers, Chas. Batchelor, John Krumm, and Martin Force, and acknowledged the above to be their signatures

Notary Public

Lantern no. 1 180 Vol 4 Ed. Records Copyrighted 1879

Bubble Voltameter

Test to obtain Electro motive Force of Battery

10 Cells. Callaud Constant

No Cells	1 Cell	2 Cells	3 Cells	4 Cells	5 Cells	6 Cells	7 Cells	8 Cells	9 Cells	10 Cells
		53	12 1/2	6 1/2	5	4	3 1/2	2 1/4		
		62	13	6	5 1/4	4	3	2 1/2		
		25	13	6	5 1/4	4	3 1/4	2 3/4		
		61	13	6	5 1/2	4	3 1/4	2 3/4		
		30	13	6	5	4	3 1/4	2 3/4		
		57	13	6	5	4	3 1/4	3		
		24	13	6	5	4 1/2	3 1/4	3 1/4		
		55	13	10	5	4	3	3		
		32	13	9 1/2	5 1/2	4	3	3		
			13	9 1/2	5 1/2	4	3 1/2	3		
			13	9 1/2	5 1/2	4	3 1/2	3		
			13	9 1/2	5 1/2	4	3 1/2	3		
			13	9 1/2	5 1/2	4	3 1/2	3		
				9 1/2	5 1/2	4	3 1/2	3		
				9 1/2	5 1/2	4	3 3/4	3		
				9 1/2	5 1/2	4	3 3/4	3		
				9 1/2	5 1/2	4	3 3/4	2 3/4		
							3 1/2	3		
							3 3/4	3		
							3 3/4	3		
							3 1/2			
							3			
							3			

Personally appeared before me this 10 day of , the said Chas. A. Hall and Chas. Batchelor, John Kruesi, and Martin Force and acknowledged the above to be their signatures.

Notary Public.

Obtained on May 2 1878 Cor. to 15.8 Callaud

Small Callaud Cell 1.42

Or 400 ohms resistance

Bubble Voltameter — Sept 15 1897 — 15

Test of Collard Battery Small Size — Gardiner 2 Volts

Commutator 100 ohms	1 Cell	2 Cells	3 Cells	4 Cells	5 Cells	6 Cells	7 Cells	8 Cells	9 Cells	10 Cells
	5'.40"	46½	12½	4	5½	4½	5½	2½	2	
		45	12½	4	5½	4½	3½	2½		
		42	12½	4	5½	4½	3½	3½		
		42	12½	4	5	4	3½	3		
		42	12½	4	5½	4½	3½	3¼		
		41	12½	4	5½	4	3¾	3¼		
		40	12½	4	5½	4	3½	3¼		
		40	12½	4	5½	4	3½	3		
		40	12½	4	5½	4	3½	3		
		40	12½	4	5½	4	3½	3		
			12½	4	5½	4	3½	3		
			12½	4	5½	4	3½	3		
			12½	4	5½	4	3½	3		
			12½	4	5½	4	3½	3		
			12½	4	5½	4		3		
			12½	4	5½	4		2½		
			12½	4	5½	4		Bad		

Entered here, Capacity of this Voltameter when Secured with 100 ohms

Chas Batchelder
Jerome Dowd
Martin Porter

Personally appeared before me this ... day of ... 10 ... this said Thos. A. Edis[on], Chas. Batchelder, John Howell, and Martin Por[ter] and acknowledged the above to be their signatu[res]

Notary Public.

Copied on page 186 Book V Exp Discussion Sept 9 11 97 JP Cameron

Kollameter Sept 14. 28

Porous Diaphragm — T. H. Edwards

Paper - To soft- [illegible] to Burst at a [illegible]

Gold Beaters Skin — Better but softens by use and becomes useless.

Cork — No better

Stopped up the hole top & the Cell and fixed a Celluloid face to the cell with hole at top & bottom thus ⊙ - Thus collects the gas in the top of the cell. This also prevents the escape of small bubbles from the face of [illegible] disc.

after passing an above current more than

Personally appeared before me this 13 day of [illegible] the said Thos. Ratcliffe, John Brown, and Martin and acknowledged the above to be their [illegible]

Notary Public.

Logbook no Page 189 Vol X Ewa Plantation Co. Apr 4 1898 McCandless

17

T. A. EDISON.

Menlo Park, N. J., [illegible] 16th 1878

Voltameter.

Copied on 1 & 9 Vol 2 Exp Record over 9, 1 & 9 C. Memo

Platina Plate

Cellaloid

Chas. Batchelor
Martin Force

Personally appeared before me this day of
12 the said Thos. A. Edison,
Wm. Batchelor, John Krusi, and Martin Force,
and acknowledged the above to be their signature

Notary Public.

Bubble Voltameter Sept 16. 78

To Edison

After instrument working over night — found heavy blackish deposit on the negative electode. possibly from the Carbon used (Solution Hydrochloric acid) -

~~The liquid~~

Used fine platina wire in place of the Carbon rod -

Result was the more even Marcus Lowry

Off of gas at negative pole probably this is comes from the fact — that the wire gives of its oxigen with more regularity than the Carbon

Chas Batchelor Assistant

Copied on P. 190 Vol 9 Bankbooks Dec 9, 1878 W Cummings

Personally appeared before me this 6th day of 10 , the said Chas. A. Batchelor, Chas. Batchelor, John Krouse, and Charles Moore, and acknowledged the above to be their signature

Notary Public.

Sept 19th 98 19

Bubble Voltameter.

To Edina Regt

Constructed a tube Voltameter to make comparative test with Bubble Voltameter to ascertain degree of accuracy

Chas Batchelor
Telegraph Operator

Tube Voltameter

Q. Cells = 2' 1½" = 2' 1½" = 2' 1½" = 2' 1" = 2' 1"
3 " = 6' 6½" = 6' 6½" = 6' 6½" = 6' 6½" = 6' 8"

Bubble Voltameter

Q. Cells = 16" - 16" - 14½" - 14½" - 14 5/8" - 14½" - 14½" - 14½
3 " = 146" - 146" - 48" → 46 - 46 - 46 - 46 - 46 - 45½ - 45 1/4

2. 52½
Personally appeared before me this day of
19 Edward Wilson, A. Pillsbury,
Chas. Batchelor, John Kruesi, and Martin Force,
and acknowledged the above to be their signature

Notary Public.

Applied for Pat. No. 4 Oct. Business 12 Oct 1878
Allowed

121¾ 121½ 121.1

	2.32	2.34	2.39	2.29	2.25	2.40	2.38½	2.36	2.36	2.47
Tube	Aspen	4	4¼	4⅝	4¼	4½	4	4	4	4¾
Bubble	Bubble	5	5	5	5	5	5	5	5	5

Radiation of Heat.

Wolfram. Johnson. Martin. Ford.

Source of Heat.	Direct Radiation	Liquid introduced in Actinograph	Radiation	Per Cent Returned
Gas jet	20.0°	4.	55.°	
" "	20.0°	9.	65°	

Personally appeared before me this ___ day of ___ 19__ the said Chas. A. Tilton, Chas. Fletcher, John Knight, and Martin Force, and acknowledged the above to be their signature

Notary Public.

Copied on Pap. 21 Vol. V
Copy Received Oct. 9. 1911
P. Marcus

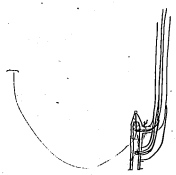
Sonoran Petitioners Sept 21st 1898

J. Briscoe

Chas Batchelder

J. H. Ellis

Martin Finck



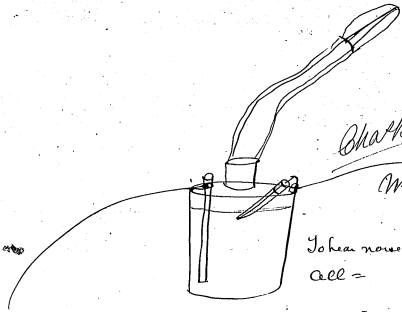
Personally appeared before me this day of
19 , the said Thos. A. Kinney,
Chas. Batchelder, John Krenel, and Martin Finck,
and acknowledged the above to be their signature

Notary Public.

Release on page 191 Court Book Records
Oct 9, 1899
JC Common

Voltameter Sept 27. 1878

by a Edison



Chas Batchelor
Samuel Kruesi
Martin Force

To hear noise on decomposition
cell =

Personally appeared before me this 10th day of Oct 1878, the said Chas. A. Batchelor, Wm Kruesi, and Martin Force, and acknowledged the above to be their signatures

Notary Public.

Copied on page 194 Vol 4 Exp Researches
Oct 9, 1878 DD Parmelee

#4

Sept 27 1878

T.A.E

Reflecting Thermometer

T.A.E

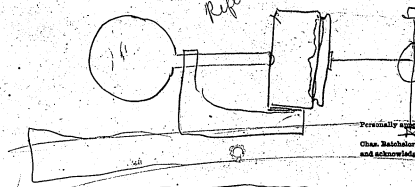
Martin Force

Stockton N.J.

Witness

Chas Batchelor

M M. Force

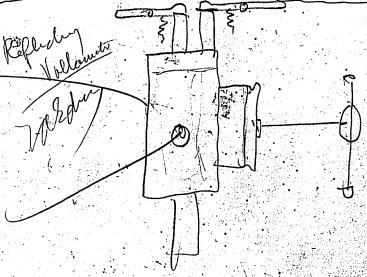


Personally appeared before me this day of 1878, the said Thos. A. Edison, Chas. Batchelor, John Kruesi, and Martin Force, and acknowledged the above to be their signature

Notary Public.

Reflecting Voltameter

T.A.E



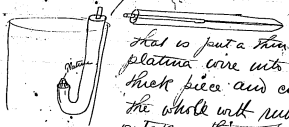
T. A. EDISON.

Sept 30, 1879

Menlo Park, N. J., 187

Mr Kruesi

Will you have made immediately the following:- instead of the platina coming out of side of rubber electrode in this instrument make one this way:



that is put a thin platina wire into the thick piece and cover the whole with rubber or take a thinner piece of wire all through and cover with rubber and then bevel off the end so that only the extreme end is seen and then warm rubber & bend round like sketch afterwards I wish you would burnish the end of platina so that the mercury will stick to it Yrs. Johnson

A NOTE ON THE SOURCES

The pages which were microfilmed for this collection are in generally good condition in the original. There are some pages, however, which due to age do not reproduce satisfactorily. We have made every technical effort to ensure complete legibility of each and every page.

PUBLICATION AND MICROFILM COPYING RESTRICTIONS

Reel duplication of the whole or of any part of this film is prohibited. In lieu of transcripts, however, enlarged photocopies of selected items contained on these reels may be made in order to facilitate research.

END

7

FINANCIAL CONTRIBUTORS

PRIVATE FOUNDATIONS

Alfred P. Sloan Foundation
Charles Edison Fund
The Hyde and Watson Foundation
Geraldine R. Dodge Foundation

PUBLIC FOUNDATIONS

National Science Foundation
National Endowment for the Humanities

PRIVATE CORPORATIONS AND INDIVIDUALS

Alabama Power Company
Amerada Hess Corporation
AT&T
Association of Edison Illuminating Companies
Battelle Memorial Institute Foundation
The Boston Edison Foundation
Cabot Corporation Foundation
Carolina Power and Light Company
Consumers Power Company
Corning Glass Works Foundation
Duke Power Company
Edison Electric Institute
Exxon Corporation
General Electric Foundation
Gould Inc. Foundation
Gulf States Utilities Company
The Institute of Electrical & Electronics Engineers
International Brotherhood of Electrical Workers
Iowa Power and Light Company
Mr. and Mrs. Stanley H. Katz
Matsushita Electric Industrial Co., Ltd.
McGraw-Edison Company
Middle South Services, Inc.
Minnesota Power
New Jersey Bell Telephone Company
New York State Electric & Gas Corporation
North American Philips Corporation
Philadelphia Electric Company
Philips International B.V.
Public Service Electric and Gas Company
RCA Corporation
Robert Bosch GmbH
Savannah Electric and Power Company
Schering Plough Foundation
Texas Utilities Company
Thomson-Brandt
Transamerica Delaval Inc.
Westinghouse Educational Foundation
Wisconsin Public Service Corporation

BOARD OF SPONSORS

Rutgers, The State University of New Jersey
Edward J. Bloustein
T. Alexander Pond
Tilden G. Edelstein
Richard P. McCormick
James Kirby Martin

New Jersey Historical Commission
Bernard Bush
Howard Green

National Park Service, Edison National Historic Site
Roy W. Weaver
Edward J. Pershey
William Binnewies
Lynn Wightman
Elizabeth Albro

Smithsonian Institution
Brooke Hindle
Bernard Finn

EDITORIAL ADVISORY BOARD

James Brittain, Georgia Institute of Technology
Alfred D. Chandler, Harvard University
Neil Harris, University of Chicago
Thomas Parke Hughes, University of Pennsylvania
Arthur Link, Princeton University
Nathan Reingold, Smithsonian Institution
Robert C. Schofield, Iowa State University

CORPORATE ASSOCIATES

William C. Hittinger (chairman), RCA Corporation
*Arthur M. Bueche, General Electric Company
Edward J. Bloustein, Rutgers, The State University of N.J.
Cees Bruynes, North American Philips Corporation
Paul J. Christiansen, Charles Edison Fund
Philip F. Dietz, Westinghouse Electric Corporation
Paul Lego, Westinghouse Electric Corporation
Roland W. Schmitt, General Electric Corporation
Robert I. Smith, Public Service Electric and Gas Company
Harold W. Sonn, Public Service Electric and Gas Company
Morris Tanenbaum, AT&T

*Deceased

The original documents in this edition are from the archives at the Edison National Historic Site at West Orange, New Jersey.

Thomas A. Edison Papers

A SELECTIVE MICROFILM EDITION

PART I
(1850–1878)

Thomas E. Jeffrey
Microfilm Editor and Associate Editor

Paul B. Israel
Assistant Editor

Susan Schultz
Assistant Editor

Assistant Editors:
Toby Appel
Keith A. Nier
Andre Millard

Research Associates:
Robert Rosenberg
W. Bernard Carlson

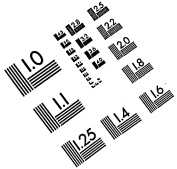
Student Assistants
John Deasey
Leonard De Graaf
David Fowler

Pamela Kwiatkowski
Joseph P. Sullivan
Barbara B. Tomblin

Leonard S. Reich, Associate Director and Associate Editor
Reese V. Jenkins, Director and Editor

Sponsors
Rutgers, The State University of New Jersey
National Park Service, Edison National Historic Site
New Jersey Historical Commission
Smithsonian Institution

University Publications of America
Frederick, Maryland
1985



Association for Information and Image Management

MS303-1980